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Original Communications.

THE SOLDIER'S HEART, AND THE CIVILIAN'S.

BY MAJOR F. SMITH, D.S.O.
Royal Army Medical Corps.

WHILE employed on recruiting duty and in charge of effective troops I have had an opportunity to compare the hearts of young civilians with those of soldiers who have just finished a course of gymnastics. The result is, I find myself suspecting that the irritable heart of the soldier has as often as not been previously the irritable heart of the civilian.

At the beginning of my duty as Recruiting Medical Officer I rejected a few men who had a persistently rapid heart-beat of over 120. I allowed each man to dress and sit quietly for half an hour before I took his pulse in final decision. Later on I made a practice of taking the pulse first in order of examination. In one or two cases I sent the men away to keep off drink and tobacco for a week and return to me; as a rule there was little improvement. My recruiting sergeants, however, were much upset by my rejecting these men for heart affections; they said their occupation would be gone if I continued to do so. When at last they were able to tell me that one of my rejected men had gone into the Marines and another into a strictly examined police force, I had to reconsider the position. On discussing the question with other medical officers I found that they mostly took it that high pulse-rate was due to excitement of the examinee, and that they therefore passed men

with high rates. The books, too, showed few rejections for disordered action of the heart. Now I pass the men into the Service with moderate and uncomplicated tachycardia.

What I wish to emphasise is that supposing these men become tired of the Service, they can come sick, complaining of pains in the chest and breathlessness, and with a little persistence they will be invalided with so-called "soldiers' hearts." They will be food for clinical lectures on the evil effects of military service, although military service has had nothing to do with their condition.

Perhaps we let soldiers go too easily with heart disorders, and, for that matter, I have an idea that some men who have organic disease of the heart could still serve efficiently as soldiers, provided they themselves were willing. However, the custom now is to invalid at once any man who has organic disease, whether there is complete compensation or not. As for men with rapid heart, or, as we say, "disordered action of the heart," they might, I think, all be made to serve on.

Below I give a return of the cases examined.

First Series.

One hundred and fourteen recruits were examined, nude and in the standing position. The following were rejected for disordered action of the heart:—

(1) A wireman, aged 19. Pulse 135.
(2) A naval domestic, aged 19. Pulse 120.
(3) A motor mechanist, aged 23. Pulse 135.
(4) A general labourer, aged 18. Pulse 120.
(5) A carter, aged 19. Pulse 112.
(6) A hotel boots, aged 24. Pulse 125.
(7) A draughtsman, aged 20. Pulse 120.

Several with a pulse of 100 were passed into the Service.

Second Series.

Twenty-two recruits were examined, nude and standing. Certain particulars regarding them were noted down. The notes as to habits, &c., are from the statements of the recruits themselves and must be accepted with reserve. The men were mostly about 19 years old.

(1) Non-smoker. Pulse 84.
(2) Cigarette smoker. Pulse 120.
(3) " " "
(4) " " "

(5) Non-smoker. Pulse 96.
(6) Pipe-smoker. Pulse 88. Smelt of alcohol.
(7) Non-smoker. Pulse 72.
(8) Pipe-smoker. Pulse 120. A footballer two years ago.
(9) Non-smoker. Pulse 120. Shoeing-smith. Gymnast.
(10) Pipe-smoker. Pulse 92.
(11) Non-smoker. Pulse 72.
(12) Cigarette smoker. Pulse 88.
(13) „ „ Pulse 76.
(14) „ „ Pulse 108.
(15) Pipe-smoker. Pulse 76. Home after five years' civil employment in Bermuda, where he had fever.
(16) Pipe-smoker. Pulse 128. A sailor.
(17) Non-smoker. Pulse 88. A schoolboy, aged 15.
(18) Non-smoker. Pulse 60. Rheumatic fever a year ago.
(19) Cigarette-smoker. Pulse 112.
(20) „ „ Pulse 76.
(21) Non-smoker. Pulse 72.
(22) Cigarette-smoker. Pulse 72.

Only seven of these men can be said to have a normal pulse-rate; this gives us roughly 32 per cent. Eight men, or 36 per cent., had a pulse-rate higher than 100. Will any one maintain that 36 per cent. should, under such circumstances, be rejected? Most of the men were passed into the Service; some of those with rapid pulse were put to severe exertion, such as running up and down stairs several times to test their wind; they stood the test very well.

Third Series.

Fifty-one recruits were examined, nude and standing. The particulars were noted a little more fully than in Series 2. Each man was asked if he had suffered from rheumatism or rheumatic fever; they all said "no." Only one man (a shop assistant) professed tō be an athlete—football and gymnastics were his amusements—his pulse-rate was 88.

Thirteen of these—say 25 per cent.—may be looked upon as having normal pulse, not being over 80 or under 65. Sixteen—or 31 per cent.—show a pulse-rate of not less than 100, four of these going over 130. Not one of the fifty-one men had any other coarse indication of heart disease.

Interesting and probably useful records would be obtained if the pulse-rate were recorded on the medical history sheet of each accepted recruit. We should then be able to find out if the rapid heart has any important bearing on efficiency.

Number in series	Occupation	Age	Tobacco: Non-smoker	Tobacco: Cigar smoker	Tobacco: Pipe smoker	Tobacco: Cigar-ette smoker	Pulse rate	Alcohol: Tee-totaler	Alcohol: Not a tee-totaler
1	General labourer	18	+	−	−	−	96	+	−
2	Brickmaker	18	+	−	−	−	64	+	−
3	Riveter	19	−	−	+	+	88	+	−
4	Brickmaker	19	−	−	−	+	88	−	+
5	Dockyard labourer	18	−	−	−	+	128	+	−
6	Errand boy	15	+	−	−	−	80	+	−
7	Painter	18	−	−	−	+	136	−	+
8	Blacksmith	19	+	−	−	−	72	+	−
9	Brickmaker	18	−	−	−	+	68	+	−
10	Schoolboy	14	+	−	−	−	72	+	−
11	Carter	18	+	−	−	−	132	+	−
12	Whisky bottler	17	+	−	−	−	108	+	−
13	Hospital messenger	17	+	−	−	−	96	+	−
14	Ropemaker	20	+	−	−	−	68	−	+
15	Hodman	20	−	−	−	+	88	−	+
16	Fitter	21	+	−	−	−	104	+	−
17	,,	18	−	−	−	+	96	+	−
18	,,	21	+	−	−	−	96	+	−
19	Brickmaker	18	+	−	−	−	112	−	+
20	,,	18	−	−	−	+	96	+	−
21	General labourer	18	−	−	−	+	92	+	−
22	Brickmaker	18	−	−	−	+	100	+	−
23	Errand boy	18	−	−	−	+	84	+	−
24	Shopman	19	−	−	−	+	92	+	−
25	,,	19	+	−	−	−	88	+	−
26	General labourer	24	−	−	−	+	80	−	+
27	Carman	19	−	−	−	+	84	−	+
28	Clerk	18	−	−	+	−	120	+	−
29	,,	19	−	−	+	+	90	+	−
30	Porter	19	−	−	−	+	72	+	−
31	Beer bottler	19	−	−	−	+	88	−	+
32	Brewer's clerk	24	−	−	+	+	124	−	+
33	Dock labourer	23	−	−	+	−	112	−	+
34	Schoolboy	16	+	−	−	−	108	+	−
35	Fitter	21	−	−	+	−	72	−	+
36	,,	21	+	−	−	−	76	+	−
37	General labourer	18	−	−	−	+	96	+	−
38	,, ,,	18	−	−	+	+	80	+	−
39	,, ,,	18	−	−	−	+	96	+	−
40	,, ,,	18	−	−	+	−	80	+	−
41	Shoeing smith	21	−	−	−	+	72	+	−
42	Shoemaker	19	+	−	−	−	84	+	−
43	House servant	19	−	−	−	+	132	−	+
44	General labourer	20	−	−	−	+	112	−	+
45	,, ,,	19	−	−	+	−	100	+	−
46	,, ,,	18	−	−	−	+	80	+	−
47	Grocer's clerk	19	−	−	−	+	134	−	+
48	Musician (bass brass)	15	+	−	−	−	84	+	−
49	Fitter	22	+	−	−	−	120	+	−
50	Brickmaker	19	−	−	−	+	84	+	−
51	General lab urer	22	−	−	−	+	96	−	+

I now give the particulars of twenty-five young soldiers—mostly Londoners—who have just completed a six months' course in the Army Gymnasium at Portsmouth. The men all belong to the 2nd Battalion Middlesex Regiment. The men were standing but not nude when the pulse-rates were taken.

FOURTH SERIES.

Consecutive numbers	Occupation before enlistment	Age	Service	Tobacco			Amount smoked in a day	Pulse rate	Alcohol		Remarks
				Non-smoker	Pipe smoker	Cigar-ette smoker			Tee-totaler	Not a teetota-ler	
		Years	Months				Cigar-ettes				
1	Sailor	20	10	–	–	+	12	120	–	+	
2	Carman ..	19	8	–	–	+	5	84	+	–	
3	Fitter	19	8	–	–	+	10	88	–	+	Variable rate.
4	Soapcutter ..	19	9	–	–	+	5	112	+	–	
5	Carman ..	19	9	–	–	+	10	84	+	–	Started rapidly, slowed down in half min. or so.
6	,, ..	20	9	+	–	–	–	84	+	–	Ditto.
7	,, ..	20	9	–	–	+	15	120	–	+	Nervous. Drank a good deal in civil life. Says a pint steadies his shakiness.
8	General labourer	18	9	+	–	–	–	86	–	+	
9	,, ,,	19	9	–	–	+	(?)	64	+	–	Blow on head in civil life. Gets headache.
10	Shoemaker ..	19	7	–	–	+	15	72	–	+	
11	Carpenter ..	19	8	–	–	+	10	88	+	–	
12	Wireman ..	19	7	–	–	+	3	104	+	–	Epigastric pulsation. Downward displacement of apex.
13	Carman ..	18	7	–	–	+	3	72	+	–	
14	General labourer	20	8	–	–	+	12	60	+	–	Pneumonia two years ago in civil life. Paracentesis.
15	Farm labourer	20	7	–	–	+	5	72	+	–	
16	Carman ..	19	7	–	–	+	20	125	+	–	Variable rate. Cardiac pain at gymnasium. Won't stop smoking.
17	Cycle maker ..	19	7	–	–	+	5	74	+	–	
18	General labourer	19	7	–	–	+	15	72	+	–	
19	,, ,,	18	7	–	–	+	5	120	+	–	
20	Engine-cleaner	19	11	–	–	+	25	72	–	+	
21	Painter ..	19	8	–	–	+	3	64	+	–	Apex a little to left, beats in pairs.
22	Porter	20	9	–	–	+	5	70	+	–	
23	Carman ..	19	9	–	–	+	5	66	+	–	
24	Fireman ..	19	9	–	–	+	10	72	+	–	
25	Porter	19	12	–	–	+	5	80	+	–	Apex displaced downwards. Says he is short-winded.

Here 40 per cent. show virtually normal pulse-rates. This is a higher percentage than that of the civilians of the same age and class. Only six—or 24 per cent.—of this series had a pulse-rate of not less than 100.

The numbers dealt with are small, but they do at least show

that the soldiers' hearts do not beat more rapidly than civilian's hearts, that the influences operating on soldiers are also operating on those of civilians.

The cigarettes smoked by the soldiers were, in each case, made of Virginian tobacco. Probably the men understated the number consumed. The columns regarding alcohol also are possibly not strictly accurate, though it is certain that soldiers are becoming more temperate than of old. We may almost take it for granted that the soldier smokes more than the civilian, for he has more money and much spare time. Most of the men who enlist are either out of work or have been getting small wages. Not one of the soldiers examined had a cardiac murmur.

The tables given above do not seem to give any clue to the cause of rapid heart. I have a suspicion—only a suspicion—that tobacco has a good deal to do with it. It might be suggested that the prospective recruits' hearts were merely excited, but there seems no reason why the young soldiers' hearts should not have been in the same condition. As to whether rapid heart is of itself necessarily a bar to military efficiency, there is abundant evidence in the negative. Military physicians are well aware that very many soldiers who have "rapid heart" do their duty without any trouble at all; just as well, to all appearance, as those with organs beating more slowly. So, though rejection of all rapid-heart recruits might reduce the number of invalids, it would certainly deprive the Service of many excellent soldiers.

My excuse for perpetrating this paper is that the subject is "in the air" just now, and I think the tables may give rise to ideas among those who have made soldiers' hearts a study.

Incidentally, the paper bears on the contention that our military position and our gymnastic training are responsible for the "soldiers' heart" and for organic disease. Only three of the men who have been through the gymnasium show any sign of cardiac hypertrophy, and that may have been due as much to tobacco as gymnastics—if indeed it was not there before the men joined the Service—for the condition was not such as would be likely to cause rejection at the hands of the average recruiting medical officer. In other respects, too, as already said, the young soldiers' hearts appeared to be at least as well regulated as those of the civilians.

If some one would examine the hearts of civilians of 30 to 35—preferably men who have travelled about the world—and compare the results with those obtained by an examination of the hearts of soldiers of the same age, some valuable information might be obtained.

SANITATION IN INDIA.

By Captain C. H. STRATON.
Royal Army Medical Corps.

I have been much interested in the article in the April number of the Journal for 1906, by Lieutenant Balck, on "Regimental Sanitation in India," and as I recently performed some of the duties of his suggested Medical Officer of Health in a large Indian station, and thereby got some insight into the working of cantonment sanitation, I should like to offer a few suggestions and criticisms based on his scheme.

The weak spot in the whole scheme is that it does not readily adapt itself for service outside cantonments. At present the conservancy of British troops is arranged for regimentally, that of native troops and the whole of the remainder of cantonments by the cantonment magistrate. In the case of native troops one sees the friction occasioned by a non-regimental control and the change of system when on the line of march.

While fully agreeing that a sanitary officer should be appointed for the station, and that he should be an executive and not merely an inspecting officer, I should still further broaden his duties. I would take all conservancy duties out of the control of the cantonment magistrate and give them to the Health Officer. In large stations the cantonment magistrate cannot devote the necessary time and attention to sanitary supervision; in small stations he is usually a regimental officer and lacks the necessary training.

On the other hand, I would leave the regimental medical officer. In large stations a Station Health Officer has not the time to perform routine inspections of minor details, and there is still the regulation weekly inspection of the men to be carried out. In the native army, too, the regimental medical officer cannot be ignored, and it is desirable that regimental sanitation should be supervised by an officer in touch with the regimental authorities. In small stations the same officer would hold both positions, and it would doubtless be an advantage if he were also cantonment magistrate.

The Station Health Officer should, in my opinion, be firstly the Sanitary Staff Officer of the Senior Medical Officer, and through him of the Officer Commanding the Station, and should deal with all sanitary correspondence, reports and returns, taking and issuing the orders of the Senior Medical Officer and Officer Commanding Station on all sanitary subjects. All reports of infectious disease made to the Senior Medical Officer should first pass through his hands. He should be a member of the Cantonment Committee. He should be an inspecting officer for sanitation of the whole

cantonment and should, under orders of the Senior Medical Officer, inspect from time to time all regimental lines, in communication with the medical officer of the regiment, who should bring to his notice all sanitary defects requiring expenditure. All minor matters of cleanliness should be dealt with by the latter officer. He should be primarily responsible for the sanitation and conservancy of the whole of the cantonment, except barracks, and would carry out the final disposal of sewage and refuse for the entire cantonment. Where trenching is employed he would detach a portion of the staff for service with regiments leaving the cantonment for manœuvres, line of march, or active service.

The entire native sanitary staff of the station should be engaged and paid by the Station Health Officer, who should be provided with a soldier clerk and soldier inspectors, trained as suggested by Lieutenant Balck, those for extra-regimental employment being transferred to the Unattached List in the same way as the staff clerks. The regimental sanitary inspectors should belong to the regiments; if there were no suitable men in the unit, men should be transferred from other units of the same branch of the Service; this should always be done on the arrival of a regiment in India. They should rank as staff-sergeants. They would draw their staff pay from the Station Health Officer. The pay of all natives of the conservancy establishment of a regiment should be drawn by the Station Health Officer, but should be paid through the medical officer of the regiment, who should be in the position of an officer commanding a company or detachment. The conservancy staff of regiments would be complete for service outside cantonments. The Station Health Officer might well have charge of the cantonment hospital; he should always be an officer of the Royal Army Medical Corps, but in large stations he should have no other hospital duties. Orderly duty in India is so light that there is no reason why a junior officer should not take his turn. He would always be available for boards and committees. The appointment should be for a definite period, say three years, in all but the smallest stations, and should never be broken, provided the officer is competent, unless he be sent on service in a similar capacity. He should render a diary monthly to the divisional sanitary officer.

I have not attempted to go into all the details of a scheme, but have contented myself with suggesting alterations in the scheme proposed by Lieutenant Balck. The title, Station Health Officer, I have adopted, as it shows the officer's duties, and its initials, S.H.O., are, I believe, unappropriated.

THE REMOVAL AND DISPOSAL OF SULLAGE WATER FROM INDIAN CANTONMENTS.

By Lieutenant-Colonel H. S. McGILL.
Royal Army Medical Corps.

This is a sanitary question that has deeply concerned the military and Army medical authorities in India for many years, and which has not yet been solved in a satisfactory manner. It may seem a matter of no very great difficulty to the English sanitarian, but in India, where there is no military station at which a water carriage system for sewage has been installed, and where financial and local conditions have to be taken into consideration whenever any method is proposed for the removal and disposal of cantonment sewage, it is one beset with many difficulties. The sullage water referred to in this paper comprises the slops discharged from regimental cookhouses and lavatories, which probably amount daily to about 1,000 gallons per regiment, a not inconsiderable volume to deal with, where there is no sewerage system. This sewage, though a weak one, is liable to putrefy and become offensive, which, together with its bulk, are sufficient reasons for its speedy removal from regimental lines. One of the greatest difficulties connected with the methods tried or suggested for the solution of this vexatious question is, that none of them has been found applicable to all military stations, while some that could deal with bath-house slops are unsuitable for kitchens. It is intended to give a description of the methods adopted or recommended from time to time, with remarks on their applicability and suggestions as to how some of them might be made more satisfactory at certain, if not at all, military cantonments.

(1) *The Catchpit System.*—This was probably the earliest, and for many years—indeed, till not so very long ago—the only method of dealing with sullage water. The slops from cookhouses and lavatories were received into catchpits, which were constructed close outside the buildings. Sometimes these pits were cemented, and the intention was to empty them by hand when necessary, but too often they were allowed to overflow and pollute the surrounding surface; or, through not being completely emptied, the residuum putrefied, caused a nuisance, and attracted flies. Many of the pits were mere holes in the ground—leaching catchpits—from

which the contents soaked gradually into the sub-soil, polluting both it and the foundations of the adjacent wall. Fortunately, this method has been abandoned.

(2) *The Bucket System.*—The large amount of bath-house slops prevents their being dealt with by this method, but it is in general use for the removal of sullage water from kitchens. The slops are discharged into covered iron receptacles holding 5 to 8 gallons, which are kept just outside the cookhouse. One receives the drainings from the sink. None of these receptacles are kept properly covered, and very frequently they are allowed to overflow, through lack of supervision on the part of the native cooks, with the result that the surface under them is constantly being soiled, as cement platforms for receptacles to stand on are not generally provided. Sooner or later a nuisance is caused, and flies are attracted to them in swarms. The contents of these receptacles are emptied daily into the waste-water cart, during which operation soil pollution invariably occurs, for the full vessels are very awkward to empty. The slops are removed in the carts to the trenching ground for burial. It was thought that less nuisance might be caused if the receptacles were kept in the kitchens. Better supervision was ensured, but the number of flies visiting the cookhouse was not much reduced, and it is certainly advisable that neither slop receptacles nor the sink should be in the cooking room. In the new pattern kitchens, the sink will be in a separate scullery. It will probably be some time before this method is abandoned in India, but I think it could be made more satisfactory if the following alterations were introduced: (*a*) The receptacles for sullage water should be replaced by a tank fixed outside the kitchen under the delivery pipe of the sink. (*b*) This tank should be large enough to hold the daily amount of slops of a company cookhouse, about 60 gallons, which result from the cleaning and cooking of vegetables, the washing of utensils and tables and the scrubbing of floors. (*c*) The tank should be placed about 2 ft. from the cookhouse wall, and raised a foot from the ground on small brick piers. (*d*) The sink pipe should enter the tank close to its top, and in the hinged lid should be an opening provided with a screw cover, just large enough to admit the suction pipe of a cesspool pump. A tap in the bottom of the tank would permit of it being flushed and disinfected when necessary. With this method, surface pollution would be obviated, nuisance would be prevented, and flies would not be attracted in such numbers to the kitchen, since the slops could be drawn direct

from the tank into the waste-water cart. If the kitchen floors were properly laid and made impermeable, they could easily be cleaned with a brush and mop instead of being swilled down with an unnecessary amount of water as at present. That the slops have to be finally disposed of by trenching is the great objection to this method of treatment.

(3) *The Surface Drain System.*—This has only been tried experimentally at a few stations, but the engineers report it could be adopted at a good number of military cantonments. The idea is to discharge all the sullage water from cookhouses and lavatories into masonry surface drains, which would conduct it from the vicinity of barracks and discharge it into a "nala" (ditch). The method was found to give very unsatisfactory results with cookhouse slops, since the small amount of fluid discharged at one time through the sink was not of sufficient volume to ensure its being carried far enough along the drains, in which it was found to form small pools, whilst the sides of the drains were covered with a greasy film that became offensive and attracted flies, so that frequent flushing with water was necessary to obviate a nuisance.

Slops from bath-houses, being a weaker sewage and less likely to become offensive, can be more satisfactorily dealt with by this method, and their larger volume ensures a better flow. I do not think the plan would prove satisfactory if the waste water had to be conveyed any distance before it could be discharged into a "nala." However, at many small stations in the hills, where only a short straight run of drain is required to conduct the slops to the hill side, the sullage water from both kitchens and lavatories might be removed in this manner, and in such cases the bath-house drain should communicate with the one from the cookhouse, so as to aid in flushing it, which could be arranged without difficulty, as these two buildings are generally in close proximity to each other. This method would not be practicable where suitable gradiants for drains are not procurable, and would be very expensive if long runs of surface drains were required.

(4) *Irrigation System.*—This method has only been tried experimentally at about twenty stations. In some the results met with were satisfactory, at others it proved a failure, sometimes owing to mismanagement. In this scheme it is proposed to apply the bath-house slops to small gardens laid out in the immediate vicinity of barracks. It is quite unsuited for crude kitchen slops, as the fatty matters in them form a scum on the surface of the

soil, clog its pores, undergo putrefaction and attract flies. Perhaps, if the slops underwent a preliminary purification, by passage through a grease-entangling trap and a downward filter, they might be applied to the land without the risk of causing a nuisance. I do not think this method would ever give satisfaction at large military stations, but I am convinced it would be found suitable for many small stations and also for detached units at large stations. There is no doubt this system has not always been given a fair trial. The gardens have been made too small, too much sewage has been applied, unsuitable ground has been selected, the management has been careless, and then they have been reported as offensive, breeding mosquitoes and giving rise to malarial fevers amongst the troops. To obtain satisfactory results with these irrigation gardens, the following conditions must always be assured:—

(*a*) *Climate.*—Places with a dry climate, such as Nasirabad, Ahmednagar, Multan and Ferozepore, or where the rainfall is moderate, as Jullundur, Agra, Jubbulpore, and Mhow, are all suitable for this method, while at Lucknow, Bareilly, Dinapore, Dum Dum, Belgaum and Rangoon, where the monsoon is often heavy and prolonged, it would probably prove unsatisfactory, at any rate during the rainy season.

(*b*) *Soil.*—Light, porous soils, such as sand, loam, regur (black cotton), and gravelly or sandy loam will be found best adapted for irrigation. On the other hand, stiff clay—unless first prepared—peat, gravel containing layers of hard conglomerate, rocky and water-logged soils, are all unsuitable. The above natural requirements must exist if a trial is to be attempted.

(*c*) *Site.*—The mistake has often been made of placing the gardens quite close to the bath-house. They should be at least 20 feet from the building, but not much more, and, if possible, laid out on a site where the ground has a slight slope.

(*d*) *Area.*—Very often the garden has been made too small, and, as a consequence, has been overcharged with the slops, which formed pools on its surface that made acceptable breeding-places for mosquitoes. The size of garden required must be estimated by the depth of porous soil and the amount of slops to be disposed of. Since a soldier in India probably uses about 1½ gallons of water per diem for ordinary ablution purposes, and 4 or 5 gallons more for his bath, the total daily output of bath-house sullage water would be 550-650 gallons per company. But as every soldier does not indulge in a daily bath, the average number being

three a week, the amount of slops to be dealt with per diem would probably not exceed 400-450 gallons per company, and perhaps less in the cold weather. It has been estimated that a certain area of one of the porous soils above mentioned will take up at a time an amount of water equal to one-tenth of its cubic capacity. Allow that the porous stratum of the land to be treated is only 3 feet in depth, then a plot 24 feet long by 20 feet broad would take up at one charge about 750 gallons of water, far more than is discharged in a day from a company lavatory. So a garden of the above size could deal with all the bath-house sullage water for one day from a company, and also with the kitchen slops if they were first purified in the manner suggested. If the stratum of porous earth was less than 3 feet in depth, a larger area of land would have to be taken up as a garden.

(*e*) *Treatment.*—No matter how favourable the foregoing conditions may be, an irrigation garden will never give satisfaction unless it is also properly made, sensibly managed and carefully attended to in all details. The following is the manner in which a company irrigation garden should be laid out and managed. Having selected a site 25 feet long by 20 feet broad, at a distance of 20-30 feet from the kitchen and bath-house, it should be marked out in two beds, each 12 feet by 20 feet, with a strip of ground 1 foot wide separating them in the middle. A small trench 6 inches deep and the breadth of an ordinary spade should be dug round each garden, leaving the central strip uncut, and similar grips should be dug across the plots at intervals of 2 feet. The earth removed from the trenches should be thrown on the little beds, the surface of which must have been first well loosened between the drains. The gardens should be connected with the bath-house, and, if its slops have been clarified, also with the cookhouse by a well-made ovoid or peg-top shaped masonry surface drain or by drain pipes. This drain should bifurcate a short distance from the garden, one arm opening into the upper trench of each plot. It should be possible to close these branch drains so that the sewage could be applied to the gardens alternately. A better but more expensive method is to dig the garden trenches a foot deep and 6 inches wide, fill them nearly to the top with ½-2 inch pieces of burnt brick or road metal, and on the top of that lay, loosely, lengths of perforated earthenware or corrugated iron gutters. By this means the absorption of the fluid will be assisted. The slops should be applied to each garden alternately to hasten absorption and prevent water-logging, and, if possible, they should be first received into

flushing tanks, which would discharge into the drains at regular intervals. When perforated gutters are not used the bottoms of the little trenches should be carefully raked up every day to prevent a scum forming on the surface, and to help the earth to breathe. Cultivation of these irrigation gardens is not absolutely necessary, but there is no doubt that it will greatly assist the absorption of water. Very often most unsuitable plants are sown. Plantains, canna and lucerne are the favourites. These certainly absorb moisture, but they also afford, during the day, a cool shelter for mosquitoes, which at night may visit the neighbouring barrack rooms, while little pools of water often form in the leaf axils of the plantains and make attractive breeding-places for the Culex. Only grass or clover should be grown during the hot weather and rains, for the transpiration of water by the leaves of these plants is stated to be greater than that of almost any other. During the cold weather lucerne, cabbage and turnips can safely be grown. I certainly think this method could be made to work satisfactorily at a good number of stations, or at least in parts of them, if suitable land was procurable close to the bath-house.

(5) *Bacteriolytic Method.*—So far this has not been adopted at any station in India, but experimental installations gave satisfactory results with both cook-house and bath-house sullage water. It was proposed to discharge the sullage water into drains, open or closed, which would convey it to a septic tank constructed at a short distance from the lavatory and kitchen. The tank effluent is passed through a filter and the filtrate would be discharged into a "nala" or over the surface of land. It has been found that the cook-house slops must be well diluted to obtain a satisfactory filtrate, and for this reason they should be combined with the slops from the bath-house, a matter of no great difficulty since these two buildings are generally close to each other. This method would doubtless yield good results but its installation would be somewhat expensive. To carry it out a small bacteriolytic installation would have to be provided for each single or double company cook-house and bath-house, or a larger one for each corps with which all the regimental cook-houses and bath-houses would be connected. This would necessitate laying a fairly extensive system of drains, which is a very expensive procedure. Again, at many stations proper sewer gradients could not be obtained, and though no fall is required for a septic tank, a certain amount is necessary for a filter, and it might not be obtainable within a reasonable distance of barracks. Suitable land or a convenient "nala" might

also not be available in the vicinity of the lines. Personally, I do not think the cost of such an installation justifiable unless it forms part of a general water carriage system and purification plant for the removal and disposal of all the sewage of the station. Nevertheless, I think it would be an admirable method of dealing with the sullage water and excreta from a station hospital and the drainings from cavalry stables, transport animal lines and slaughter-houses, since the sewage from the last three is, at present, often discharged into an open ditch. One installation would meet the requirements of each of these places, and suitable land is nearly always available in their immediate vicinity for the reception of the filtrate—which could also be safely discharged into a " nala."

(6) *The Water Carriage System.*—This has not yet been introduced to any military cantonment in India, excepting Colaba, which is connected with the Bombay municipal drainage system. Unfortunately, there are many obstacles to the introduction of this system into military stations. For instance, at Rawal Pindi, Mhow, and Jhansi, the want of sufficient water for the working of the system prevents its installation. Again, at Lucknow, Meerut, Umballa, Peshawar, and probably Nowshera, although abundant water is obtainable, the dead level of the surface makes it difficult to procure the necessary gradients for the sewers. While at some smaller stations, where neither of these drawbacks are met with, the cost of the installation would make it almost unjustifiable if only the requirements of a small garrison had to be considered. However, there are large, important and permanent military stations—such as Quetta, where the project has been shelved for the present, Poona, Secunderabad and Bangalore—at which a water carriage system connected with a bacteriolytic purification plant should be introduced, regardless of expense, as soon as possible. Jubbulpore, Agra, and Bareilly might be more gradually dealt with, while Fort William (Calcutta) and Rangoon Cantonment should be connected with their municipal drainage systems. In the case of quarters for regimental and departmental warrant officers and staff sergeants, which are small buildings, officers' messes, and private bungalows, all sullage water could be safely disposed of by discharging it into a catchpit filled from below upwards with layers of stone, coarse and fine gravel, on the top of which is placed a perforated earthenware slab. The kitchen slops should be first strained through a metal vessel filled with straw to entangle the grease which, if not removed, would soon clog the filter.

I think I have mentioned the drawbacks connected with each system that would prevent any one of them being adopted for all military cantonments in India, and have pointed out the defects of those that have been tried, and I think it may be conceded that the removal and disposal of sullage water at Indian stations is, after all, not such an easy matter to settle. Personally, I think it is doubtful if any method will be found applicable for both kinds of slops at all Indian stations. I will conclude my remarks with suggestions as to how the difficulty might be met.

(1) By the gradual introduction of a water carriage sewage system at all large military stations which present no obstacles to the method, and the connecting of cantonments with municipal drainage systems, when such are in existence. The measure would be expensive, but the cost would be compensated by the reduction of enteric, dysentery and malaria amongst the troops.

(2) At small hill stations, and perhaps some others, by discharging both cook-house and bath-house slops, the former, after filtration, into masonry surface channels or drains which would remove them from the vicinity of barracks and dispose of them down the hill-sides or in a ditch. This plan would not be suitable for large stations, where a long line of drains might be required.

(3) By irrigation gardens at small dry stations in the plains, where a suitable porous soil is available, the cook-house slops being first filtered.

(4) For small units—as a battery—and for station hospitals, cavalry stables, transport animal lines and slaughter houses, a small bacteriolytic installation of septic tank and filter beds would meet all requirements. At the station hospital it should also deal with the excreta and urine. If adopted for regiments the expense would be pretty considerable.

(5) By substituting slop tanks for the present cook-house receptacles and emptying them into the waste-water cart by means of a cesspool pump. The great drawback to this method is that the slops would still have to be disposed of in trenches. It is difficult to say what else can be done unless the slops were passed through a septic tank and filter beds, the resulting filtrate being applied to land or run into a "nala." If such an installation was agreed to, it should be large enough to deal with all the cook-house sullage water of the station. Unfortunately, bath-house slops being so voluminous, about 3,000 gallons per diem per regiment, could not be removed in the waste-water carts, which

only hold 60 gallons each, and would still have to be discharged into drains and "nalas," or over land, or conveyed by a series of long masonry channels to a septic tank. Whenever slops or filtrate are run into ditches, particular attention should be paid to prevent them stagnating and forming mosquito pools in the vicinity of barracks. A committee of medical and engineer officers should determine the system most likely to prove satisfactory at the various stations. I have only considered this question of sewage disposal in its connection with military cantonments, but it is just as important a problem for most civil stations in India, where, as a rule, the method in vogue is discharge of the slops into open masonry drains, or ordinary ditches.

2

ENTERIC FEVER—THE WATER-BORNE THEORY.

By Lieutenant-Colonel H. A. HAINES.
Royal Army Medical Corps.

As Major Norman Faichnie's very interesting paper on the water-borne origin of enteric fever, in the May number of our Journal for 1906, has not drawn forth the protests that might have been expected, with the exception of Surgeon-General Quill's decisive remarks on the Ceylon outbreak amongst the Boer prisoners of war, may I offer a few criticisms?

His first point is a comparison of *Indian with English barracks*, in favour of the former. This is rather a " tall order." I think that most officers who have been in India have seen some very "essential differences," *e.g.*, to mention only a few, the ground all about Indian barracks is polluted by human and animal excrement ; I have seen the native cook urinating outside the kitchen. Has any one seen the soldier using the barrack square in England as a latrine ? Or do the contractors and followers in England relieve themselves round the first corner, as is done every day out here (India)? In England the latrines are "flushed about four times a day." How often here? Has anybody seen at home anything like the clouds of dust whirling round inside the latrine which we see here? Is it possible to see no difference between an English and an Indian kitchen ; the native cook squatting in the dust before a table two inches high, holding the meat or the knife between his toes? And his dusters! In an officers' mess cookhouse recently I found they had only three dusters for the day ; two of them would make a decent ink ; the third was a little whiter, so that, alas! its original sphere could be seen; it was the tail of a shirt!! Of course the officers had enteric fever, but the problem was not how they got it, but how some of them escaped.

Camps.—Under this heading it is rather feeble to say that there is no advantage in England; the very thought of camping in a green English field makes the Indian camper's mouth water enough to wash down the dust which sticks between his teeth. Dust itself can hardly be supposed to be a cause of enteric; it must first be liberally mixed with the bacilli, as out here; the same applies to flies; and I maintain that this very essential difference does exist, that the allowance of enteric bacilli is as 19·6 in India to ·8 in England, or probably more.

Milk Infection.—This in India, Major Faichnie says, can be ignored as a cause of disease. But why? Because of the great care taken in keeping out dust and flies. Water for washing utensils and for adulteration is as much used here as at home, hence we may conclude that the water here must be purer than where milk epidemics occur.

Nature of Incidence.—In most Punjab stations water for drinking is stored in iron receptacles, one for each barrack; these have iron taps, and every man gets the same water. I have never seen the earthenware *chattie* in use, which is so rightly condemned by Major Faichnie. If the iron receptacle was infected, the first drink should give enteric to all the susceptible young soldiers on arrival. I have never heard of such an outbreak in India.

As to the Lincoln epidemic, infection by contact for the secondary cases is just as reasonable a hypothesis as "dead ends," especially as when attention had been directed to the water, people would have boiled the water or not drunk it, and there should have been no more cases. It is not apparent why the bacterial slime should collect or form at one period, to be all washed away later on, the force and amount of water being presumably the same, or even less, in Lincoln, as some of the supply was imported after the epidemic had begun.

The strongest argument adduced by Major Faichnie is certainly the non-contagiousness of milk epidemics; it would be most interesting if we could compare a milk with a water epidemic in the same area. Secondary cases can hardly be absent when a milk epidemic goes on for two months, as at Marylebone.

Major Faichnie's remarks as to the heat required to kill Eberth's bacilli are not quite in accord with Dr. P. G. Griffith's experiments given in the September number of the Journal for 1906.

With reference to the enteric in Jacksonville, Lexington and Knoxville, some people would at once think of the greater facility for contact infection amongst troops than in civil life, and if pure water was piped or carried it should have washed away the bacterial slime as supposed for Lincoln.

Personal Infection.—If sixteen nurses per annum are infected in London amongst educated people trained to deal with infectious disease, how many might we expect amongst raw country boys thrown together in new circumstances?—illiterate men, knowing nothing and caring less for the simplest principles of sanitation.

Presidency Towns and Agra.—The great danger from the

storage vessels is exactly the same here as in other barracks, and the supply is originally no purer; as to Agra, the great improvements count either way.

Ashanti Campaign of 1896-7.—Probably, as the water was so well looked to, the other important points were also driven home; as the force was small this could well be done.

Nile Barage Works.—With people camped out on burning sand the bacilli had no chance.

South Africa.—All evidence of contact infections, &c., is ignored.

Quetta.—Has a drop in the number of cases from two hundred and thirty-two in 1898 to twenty-six in the following year no meaning? Is "sanitation useless" which prevents two hundred and six cases of enteric in one year? In diets alone it means nearly £3,000.

Ceylon.—The remarks under this heading are sufficiently refuted by Surgeon-General Quill's able article in the September number of the Journal for 1906.

I would like to learn why the enteric bacilli will live in the friendly *chattie* and bacterial slime and not the cholera germ. The latter lived in the old sand filter, as a regiment found to its cost in Lucknow. Major Faichnie truly remarks "that cholera has been stamped out while enteric increases," and this proves, he thinks, "that the poison of the latter is more diffused." This is, indeed, the whole secret, as the supply of a pure water being sufficient to eliminate cholera, and insufficient to do the same for enteric, proves. A diffusion of the latter beyond the water, *i.e.*, to dust, flies, &c., and those regions beyond, are now the objectives for attack in India.

While disagreeing with the main contention of Major Faichnie's paper, I think that I may say we all appreciate it, and in this most interesting of all discussions it would be unscientific in the extreme to make light of any argument. Our enemy is protean, so must our attack be from every side.

A few further facts that it seems to me are not sufficiently considered may be briefly indicated. One is the marked immunity from attack of soldier's wives—they have the same water supply, and their system of storage differs only from that of the troops in being much worse.

I think one of the important differences in the conditions of sanitation of officers and men and of families is the attention the women pay to their dusters. The native cooks of both officers and

men throw the dusters about the floor, wipe their hands and faces with them, wear them as neck comforters, wipe the outside of pots with them, and keep them in use till black; whatever microbe is in or near the kitchen is therefore taken up and rubbed on to every plate, cup, &c., used. On the other hand, the soldier's wife keeps the *jharon* in her own possession and uses it for none of the above objects. When a married soldier or member of his family gets enteric it is probably the case that his wife has employed a *bawarchi* instead of doing her own cooking.

The varying monthly incidence of enteric in this country forms, I think, a serious objection to the water-borne theory. The supply and storage system seldom vary in the twelve months, while the enteric varies widely. Polluted water in Lincoln, as elsewhere, produced its effect in six weeks; why do not the drafts of young soldiers get the disease soon after landing in India? They drink the suspected water for six to twelve months before getting ill, and then they generally fall sick in ones and twos at a time, quite unlike water epidemics.

The enteric cases at Dalhousie in 1906 form an interesting commentary on this discussion. During the month of April about 2,000 Europeans marched up from the plains; all had the same water to drink. In only one regiment were there more than three cases of enteric fever during the season. The disease was prevalent in its plain station at the time it left for the hills. The admissions were spread over the eight or nine weeks subsequent to their arrival in Dalhousie and then ceased, except for a married man two months later. Now, if they had drunk infected water before leaving their station, why did they not all develop the disease after the usual period of incubation? It could not have been the water on the road up, or in Dalhousie, otherwise the young soldiers of the other regiments would have contracted it. As the cases nearly all came from two out of the four companies in the party, I conclude that the majority, if not all, were "contact cases." A very suggestive fact was that one of the first cases in the plain station was that of the quartermaster-sergeant, whose store, of course, has to be visited by all the recruits. A peculiarity of the attacks was the number of hæmorrhages, viz., 50 per cent., which resulted in the high mortality of 30 per cent. Only one man of the nineteen confessed to being temperate. The whey, &c., treatment of Dr. Ewart was carried out.

NOTES ON ENTERIC FEVER PREVENTION IN INDIA.

By Lieutenant-Colonel F. W. C. JONES.
Royal Army Medical Corps.

It is with much diffidence that I approach the well-worn theme of enteric fever prevention, and, incidentally, of other filth diseases in cantonments and on manœuvres in India. Experts have written much on the subject. To use efficiently the knowledge given by them to those of our Corps who are daily engaged in the fight against these diseases is no easy matter. Very definite lines are often not laid down to act upon, and, indeed, sometimes the suggestions made in the laboratory are quite impracticable for us working men. But without the knowledge so gained we should be fighting the air. In this connection our thanks are due for the very helpful articles which appear from time to time in our Journal.

What we want is a system of general sanitation which is practicable, and gives good results. Easily said! Well, show us one. My answer is that we have been working in Nasirabad for the last two and a half years on definite lines, and with a definite object in view.

We have been led in this station to regard fly infection as the principal cause of the unenviable prevalence of enteric fever. Reference to the table on p. 25 will show the occurrence of this disease for the last twelve years. Up to the end of June of this year (1906), there have been two cases and no deaths. I will now tell the tale of our fight.

My personal knowledge of this station dates from early in April, 1903, when an epidemic of enteric fever was raging. A battalion landed from Cairo, and arrived at the station in February of the same year, and was at once attacked. It would be beside our present purpose to go into the outbreak in detail. It is, perhaps, sufficient to say that practically all the cases were of local origin. A young regiment newly landed in India is not likely to grasp at once all the details of Indian sanitation, and this was no exception. Many necessary precautions were not taken. The milk supply was open to suspicion. The water was boiled in Larymore boilers, but was not very efficiently guarded afterwards. Doubtless many other sanitary sins were committed. But these have been committed before with more or less impunity. Our

investigations into the cause of the sudden outbreak ended in the way so familiar to Army surgeons in India. My predecessor in command of the Station Hospital had called special attention to the enormous number of flies present in this station immediately before and during the outbreak. He also brought to notice that these flies were being imported on the carts from the filth pits. On my arrival there were swarms of these pests, but not nearly so many, so I was informed, as there had been. This was probably due in part to an order that all filth carts were to ply at night, and in part to the advance of the hot weather drying up other fly-breeding grounds. Energetic measures were taken to close all possible ways of infection that could be thought of. The epidemic ceased, but cases kept on occurring to the end of the year in spite of all our efforts. Flies were with us. We feared them, and yet were more or less powerless to fight them.

On December 8th, 1903, the cantonment authorities started the system of filth trenching recommended by Lieutenant-Colonel H. B. Thornhill, C.I.E., Indian Army Inspecting Officer of Cantonments in India. I had the advantage of an interview with Colonel Thornhill. He pressed his views with the vigour of an enthusiast. A sceptic then, I have since become a convert and on ardent disciple. I can say the same for the officers of the Royal Army Medical Corps working under me here—Captain W. H. Odlum and Lieutenant A. L. Otway. This system differs very essentially from the Allahabad system as detailed in Lieutenant-Colonel R. Caldwell's recent work on Military Hygiene. Even if efficiently worked, the Allahabad system, according to Colonel Caldwell's account, results in the breeding of a large number of flies. Each pit is a fly incubator. This when properly worked; how much more so when not so well carried out, as in this and other stations that I know. From frequent personal inspections of our filth pits before the introduction of Colonel Thornhill's plan, I can vouch that they were seething with maggots and covered with thousands of flies. Ravens and "shorks" abounded, and evidently found suitable food. As in the Allahabad system, Colonel Thornhill allows a trench 16 by 5 by 1 feet for each Crowly cart, but he directs that each trench should be dug out to its full depth of 1 foot. The earth is thrown to one side, and thoroughly pulverised. Enough trenches to receive the contents of the carts are dug a day in advance, and measured by an inspector with iron rods.

Let us now follow the course of a filth cart. Here might be

noted how "kutcha" these carts are. Probably owing to want of funds an inferior cart is built. The lids hardly ever fit properly, and in spite of a layer of earth in the pan the contents frequently slop over. It might be a little more costly, but surely it would be more satisfactory to have efficient lids which could be fastened down by a strong lever. But to our story. The cart is driven up and the buffalo or bullock unyoked opposite and close to a trench. The cart is then man-handled until the wheels rest on the clear edge of the trench. Previous to its arrival 2 inches of earth are sprinkled, with a circular movement of the spade, evenly over the bottom of the trench. The contents of the cart are tilted in. Powdered earth is then thrown into the cart, and the inside is given an earth bath, and is thoroughly scraped with a wooden scraper. The cart is then taken to a similar trench and washed over it with water inside and out. Colonel Thornhill's original plan was to wash four carts in a trench of the same size as a filth trench, but we find it more convenient to wash one cart in a trench one quarter of the size. The depth is always 1 foot. The carts can be placed right over a trench of this size and cleaned with practically no surface pollution of the ground. After the cart has been taken away from the trench into which its contents have been emptied, the sweepers cover the excreta with the powdered earth, throwing it in with a circular movement. At about 5 inches from the bottom of the trench a semi-solid mud is thus formed on which the remaining 7 inches of powdered earth rests and form a dry covering. The immediate results of this system are marvellous. There is no smell. You can walk to leeward of a freshly filled line of trenches and not know they are there. When the earth is properly powdered no flies are bred; this one can see at once by their absence. Indeed, when inspecting the trenches, if we see flies we know that something is wrong, and begin to hunt for larvæ in the more recent pits. The flies are bred when the earth is improperly powdered. The clods, with air chambers round, act as ladders for flies to go up and down. When the work is scamped the same result follows. To carry out this system efficiently, removal of filth must be carried on by day.

Though we started Colonel Thornhill's system in December, 1903, it was not until three or four months later that it was in perfect working order. To begin with, a sufficient number of diggers could not be obtained, and consequently the trenches were only 12 by 5 by 1 feet. Flies diminished greatly, but not to the same extent as after the work was carried out completely. We

look upon flies as a danger signal. Ravens and "shorks" at the pits are also danger signals. With a large native bazaar close to, it is impossible at present to prevent the breeding of flies. We find them after wet weather in the roads and wherever cattle are kept. But while we cannot prevent flies breeding altogether, we can prevent breeding the flies which chiefly matter, namely, those in the filth pits.

With the economical side of Colonel Thornhill's plan we have nothing to do at present. He claims that with a good rainfall it is a fruitful source of income to the cantonments. The trenched ground is, of course, cropped before being again used for trenching.

STATEMENT SHOWING ADMISSIONS AND DEATHS FOR ENTERIC FEVER, ETC., FOR THE PAST TWELVE YEARS.

Year	Strength	Enteric Fever		Rainfall	Remarks
		Number of admissions	Number of deaths	Inches	
1894	755	15	3	Not available	
1895	881	21	7	22·1	
1896	765	29	12	13·6	
1897	698	25	12	18·5	
1898	668	28	11	15·2	
1899	838	42	10	7·5	Famine year.
1900	781	56	21	14·3	
1901	681	33	7	17·8	
1902	370	18	5	10·9	Note small number of troops.
1903	673	82	16	17·5	
1904	780	17	4	15·6	Colonel Thornhill's system started December, 1903, inefficiently, and efficiently in April, 1904.
1905	926	4	*Nil.*	4·5	Famine year.

Believing, as we do, that flies are the chief carriers of enteric fever in India, any plan which gets rid of them is worthy of consideration. Incineration is an ideal system, but if earth can be fertilised, and the desired end gained at the same time, cheaply, a plan such as Colonel Thornhill's is more likely to meet with acceptance by the authorities who hold the purse strings.

In 1899 Larymore boilers, for the provision of sterilised water to troops, were brought into use in India. Therefore a comparison of the number of enteric fever cases should be made from that date when consulting the above table. The rainfall has been introduced into the table to show how little effect its deficiency or

excess had on the number of cases of enteric fever. Why should it? Under the old trenching system the water necessary for fly-breeding was brought to trenches in the filth carts and emptied there. We do not hold that enteric fever cannot be carried by water. We, of course, know it often is. What we say is, that the care in obtaining a good water supply for European troops all over India should have led to more satisfactory results if water is the chief means of conveying the disease. It has practically eliminated cholera. Why not enteric fever? To our minds the statement that all loopholes for water infection have not been closed does not carry conviction. Nay, it practically accuses us and our professional brethren of want of zeal. To some grosser cause, as a rule, must be attributed enteric fever in India. If possible, it is better to attack the main cause of the disease at its source, and not to leave it to regimental officers and individuals to fight the germs when already in their barracks. These second lines of defence are necessary, however, and we keep them up. Acting on the faith that is in us, we have been working here for two and a half years to prevent fly infection. Though we remember the *post hoc, propter hoc* argument, we appeal to the table given, and we earnestly hope that the results are due to our endeavours. We work with a clear idea of what we want. No flies, little or no enteric fever.

By fly infection we mean the pollution of milk, water (?), food, &c., &c., by flies from infected excreta. The trench-ground at Nasirabad is on the opposite side to the prevailing wind, and from one to two miles from barracks. The soil is sandy, but very fertile when watered.

I have not mentioned dust because I do not think it is a cause of infection in this station. Our dust storms occur usually in the hot weather, when enteric fever is not particularly prevalent. Also, it would take a very robust germ to stand the drying powers of a Rajputana hot weather sun. Further, the country on the side of the prevailing wind is open and uncontaminated.

Many strong drafts from home have come to the station since our new system was started. Also the regiments have been changed.

In our manœuvres in this brigade we have been working with the same end in view, *i.e.*, the prevention of fly infection as far as possible. I venture to append our camp instructions marked A. They were adopted at the Mhow divisional manœuvres in 1904-5 for all troops, and were in use at our short manœuvres here during the winter 1905-6.

Readers of our Journal will notice that much of the matter in these instructions has been taken from a very helpful article by Lieutenant-Colonel H. S. McGill (vol. iii., No. 5). He will, I hope, be pleased to know that his suggestions have been put into practice and found most useful. Mr. Ernest E. Austen's article in vol. ii., No. 6, is also very instructive.

There is a word, I believe, with a very unpleasant sound, and more unpleasant meaning. The word is kakophagy, or excrement-eating. I presume no one wishes to be a kakophagist; yet we are so in spite of ourselves, if flies bred in filth pits alight on our food just before we eat it. I found this line of reasoning very useful with high caste native officers and men on manœuvres. They at first looked upon our sanitary measures as being only meant to worry. I got several of them together, and, to the best of my ability, explained that men who took no precautions in camp to prevent the breeding of flies, must, of necessity, be kakophagists. This appealed to them most strongly, and I had no further trouble.

I must apologise for inflicting this article on my professional brethren, but I believe that it expresses the opinion of a large number of our officers in India.

The reading of Major Norman Faichnie's article in the Journal for May, 1906, prompted me to take up the cudgels on behalf of the fly-infection school, and to give reasons for our belief. Will not fly infection alone almost account for enteric fever contracted on trek in the late war in South Africa? Some who read this may remember that horrible place Blinkwater, to the north of Middelburg in the Eastern Transvaal, with all its abominations. The running stream of clear, and apparently pure, water would not, I believe, account for the cases of enteric fever contracted in that awful place. Flies in thousands were there bred in uncovered latrine pits, in unburied offal, in dead horses and mules. Many of us who were shut up in Ladysmith will attribute much of the enteric fever there to fly infection.

I append A and B, Sanitary Recommendations, issued to commanding officers, and C, Advice to Young Soldiers in India. Copies of the latter are hung up in every barrack-room. These form our second line of defence should germ-bearing flies enter the barracks.

APPENDIX A.

Sanitary Notes and Recommendations for Marching and Manœuvres.

Diseases.—The chief diseases to be guarded against on the march or in camp in the winter are:—

(1) Enteric fever—from foul water and milk, and fly infection of food.

(2) Diarrhœa and dysentery—from foul and muddy water, bad food, chill.

(3) Malarial fever attacks—frequently from chill in those already infected by the parasite.

(4) Bronchitis and pneumonia—chill, especially from standing in a cold wind in wet clothes.

(5) Cholera and plague—the former from contaminated water and food, and the latter from infection.

Clothing.—Men should wear flannel next the skin, and always have a great coat ready to put on after marching, while waiting for the baggage to come up. They should always put on a dry pair of socks when the march is over after washing or drying the feet. Before marching they should soap the feet well, or rub them with grease. Blisters should have a needle passed through the bleb to let the fluid out. The skin should not be cut off. The men should be supplied with three blankets and a waterproof sheet each.

Water.—The allowance required daily for each man is three gallons—half for washing and half for drinking and cooking. In a running stream the water intake for men must be above that for washing and for animals. A guard or policemen should be put over the drinking water, and it is advisable that this guard should proceed with the advanced party. A space of twenty yards radius round the drinking water supply should be kept clear of tents, cooking places and animals. A water party under a N.C.O. should be sent on in advance (for infantry the evening before) to have water ready boiled and cool for the troops on arrival in camp. For storage one large McNamara tank will suffice for a battery and two for a battalion of infantry. The water can be boiled in these tanks. All water should be kept at the boil for half an hour. Water bottles and mule tanks should be filled from this supply of boiled water and from no other source. Two covered zinc water buckets (now in use in barracks) should be taken with each battery, and six with a battalion of infantry, to be used in distribution. Ropes and buckets (zinc or leather) will be required to draw water from the wells.

Cooking.—Cookhouse water and refuse must not be thrown about. This attracts flies. Two pits 2 feet in diameter and 2 feet deep, and with the bottom earth loosened 6 inches more, should be dug 20 yards away from each company cookhouse. One of these is for water and one for garbage. Dry earth must be thrown in each several times a day, and on leaving camp a layer of litter 4 inches deep should be burnt on each, and the pit then well covered in with earth.

Refuse.—Refuse (other than cookhouse garbage) should be collected several times a day (in sacks if possible), and taken well to the lee of the camp and burned; but see below for standing camps. In these a pit 4 feet deep and 4 feet across should be dug and the refuse thrown in it and burnt.

Latrines and Urinals.—These should be marked by flags for Europeans and natives. They should be at least a hundred yards away from the nearest cookhouse or cooking-place, slaughtery, or bakery. They should be of the following size for camps used for one day only: 20 feet long, 2 feet wide at the top and 2 feet deep, makes a trench large enough for 100 men. Three trenches as above, but 50 feet long each, will suffice for a battalion. If the camp is occupied for longer than one day all trenches should be 4 feet deep. This applies to cookhouse pits and pits for refuse (which should then be dug). A pit 2 feet broad and 2 feet deep, with the soil loosened for six inches more, should be dug at the end of each latrine for use as a urinal. Dry earth should be thrown into the latrine pits several times a day. In standing camps a layer of rubbish 4 inches deep should be burnt in each latrine and urinal once a day. This should also be always done by the party left to close the latrines, even if the camp has only been occupied for one day; this to prevent flies being bred. In standing camps all latrines must be filled in when the excreta reaches to 2 feet from the top. In camps only used for one day earth must be piled up for a foot over them when closed. Men should be prevented from urinating in and near the camp except in the urinals.

Stable Litter.—This should be partly used for burning in the filth pits, the remainder being collected and burnt outside the camp.

Slaughtery.—The slaughtery should be at least 100 yards away from the camp and latrines. All offal should be burnt or buried in pits 2 feet deep (4 feet in standing camp). The same precautions should be taken as for latrine pits.

Dead Animals.—Carcases of dead animals should be buried if possible after the entrails have been taken out. Failing this the entrails should be taken out and a grass fire lighted inside the bodies. The entrails should be buried.

Food.—Men should have tea or coffee and bread or biscuit before marching. Milk must be boiled for half an hour, and then protected from flies and dust.

General Recommendations.—All villages should be placed "out of bounds," and no unauthorised natives allowed to enter camp.

APPENDIX B.

Second Line of Defence—Sanitary Recommendations.

(1) *Water.*—It must be recognised that our present supply is liable to contamination at the intake, and therefore must be looked on with suspicion. Cantonment well-water is almost certainly badly polluted in every case. To try to make and keep our drinking water pure after being taken from the taps:—

First.—After the Larymore boiler is filled no native should have anything at all to do with the water. All work should be done by soldier.

Second.—The tap water must be boiled in the Larymore boiler, the whistle going for ten minutes.

The boiler should be cleaned inside once a week with a scrubbing brush on a long handle by a European. The brush must be used for no other purpose and kept by the non-commissioned officer in charge of water supply. If further cleaning is required clean ashes should be used. Under no circumstances should sand or earth be used for this purpose. The Larymore boiler should be filled from a tap over it. Until this can be arranged the boiler should be filled by open buckets. Under no circumstances should the same buckets be used for filling the boilers and then distributing the boiled water. This is a very dangerous practice.

Third.—The water should be carried in covered buckets from the boiler to the large zinc receptacles (McNamara). These should be locked. The covered buckets should be rinsed out with boiled water daily before use and scrubbed once a week with clean ashes and a small brush. This brush must, of course, be under charge of the non-commissioned officer in charge. The zinc receptacles should be scrubbed out with the same brush, and clean ashes and boiling water once a fortnight. As these vessels (buckets and receptacles) are for storing boiled water, it is obvious that only boiled or boiling water should be used in cleaning them. Tap water should never be used.

The brush should be put in boiling water before use. The man who cleans the buckets and receptacles should wash his hands and arms with soap and hot water before he commences his work of cleaning. Each large zinc receptacle for storing water should be provided with two white drill covers reaching to four inches below the top. A string should be run round the edge so that the cover can be drawn tight round the receptacle. This is to keep out dirt. One cover for use and one to wash. Water in the receptacles should be pinked with permanganate of potash.[1]

Fourth.—The water from the zinc receptacles should be drawn off and stored in "surahis" (scale, one "surahi" for every six men at least) with narrow necks and a tin cover to each. Wide mouthed "chatties" into which a man can get his hand should never be used for storage of water; they are a great source of danger. The date of issue might be painted on each "surahi," and every month all "surahis" should be broken.

These instructions carried out carefully in every detail should ensure that a man can always get a drink of pure water. Those who drink other water run a very good chance of getting enteric fever. Water is dangerous when: (*a*) It is not boiled; (*b*) though boiled it is afterwards fouled with dust; (*c*) though boiled it is afterwards fouled with flies; (*d*) though boiled it is afterwards fouled with dirty hands; (*e*) though boiled it is afterwards fouled with dirty vessels.

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[1] Mere pinking does not make impure water pure. It only delays bacterial growth.

Beer adulterated with impure water is very dangerous.

Boiled water is pure water, so that any microbe infecting it has a fair field. It finds no enemies, and can grow freely. Therefore we must keep our pure water free from infection. It must be remembered that the ground near barracks, &c., is foul, and probably infected with the enteric microbe, this microbe being passed in the urine as well as by the bowels. The microbe is only waiting an opportunity to poison us, and is probably always with us; we can keep it out easily if we will only take care. The cholera germ only visits us occasionally, but everything in these recommendations applies to it also.

(2) *Milk.*—All milk is open to suspicion, even if the cows are milked in our compounds. It must be boiled before use. For soldiers this should be done in barracks. No native should be allowed to sell milk in the barracks unless it has been boiled under European supervision, and placed by a European in a clean can and locked. This can should be first scalded out with boiling water. After boiling, milk must be kept carefully covered to prevent fly and dust contamination.

(3) *Cookhouses.*—Cookhouse floors should be sprinkled once daily with phenol in boiled water (a tea-cupful to a gallon) and the floor kept clean by brushing. This work should be done by the cooks. The cooks should each have three suits of white clothes and three white caps. They should always change their clothes and wash their hands with soap and water outside the cookhouse before commencing work. Basin, soap and clean towels should be provided for this purpose. Their own clothes should be kept outside the cookhouse. No one should be allowed to sleep in a cookhouse. Flies should be kept out, but if large numbers get in they should be killed by sulphur fumes (sulphur ½ lb. to be burnt in a cookhouse after closing all openings). Cooking pots, &c., should be cleaned when necessary with clean ashes and coir. It is advisable to have special tin boxes for cleaning utensils. Sand or earth should never be used. Clean "jharans" should always be available. No sweeper should be allowed to enter a cookhouse on any pretext. Proper covered receptacles for liquid and solid refuse separately should be kept outside each cookhouse. No water refuse of any kind should be thrown on the ground outside. The soldier in charge should be responsible that these instructions are carried out.

(4) *Barracks, &c.*—Barracks, canteens, coffee shops, R.A.T.A. rooms, &c., should be swept out only by soldiers. No sweeper should be allowed inside them. Dining tables and the floors round them should be washed and kept scrupulously clean. Flies come to dirt, and flies are dangerous. No water should be allowed to accumulate or become stagnant. If mosquitoes abound, a report should be made. Mosquitoes (Anopheles) cause malarial fevers, and they can be easily got rid of. They and other mosquitoes breed in undisturbed water. Let in all the air and light possible.

(5) *Soda Water Machines: First.*—Ensure pure water by boiling and then passing through a Pasteur or Berkefeld filter. The fittings of the various parts of the filter must be most carefully attended to. The candles should be boiled in water for half an hour every week.

Second.—Wash the bottles in boiled and pinked water which must be changed every day. Pinking alone does not mean safety.

Third.—Syrups must be carefully guarded from contamination by flies.

If flies swarm burn sulphur with closed doors, &c. (of course, no one remains in a room when sulphur is being burnt).

(6) *Bazaar.*—Soldiers are most earnestly recommended neither to eat nor drink in the bazaar.

(7) *Sanitary Supervision.*—Apart from the ordinary sanitary supervision by company officers, I advise that one man per company and one for officers' compounds should be told off under the sergeant in charge of sanitation to see the foregoing instructions carried out. This sanitary corps might also act as a "mosquito brigade," being instructed in the work by a medical officer.[1]

APPENDIX C.

SECOND LINE OF DEFENCE—ADVICE TO YOUNG SOLDIERS IN INDIA.

With Care You can keep your Health in India in Spite of the Unhealthy Season.

The chief diseases you must avoid if you would keep healthy are enteric fever, heatstroke, diarrhœa, dysentery, and abscess of the liver, ague and other malarial fevers, cholera, venereal diseases, and alcoholism.

November, December, January, February, and March are nearly always cool and very healthy months, in which you can go out freely all day long, and do hard work. April, May, and June are very hot. During these months you must be careful not to get heatstroke. July, August, and September are rainy months, and in October the rain puddles, &c., are drying up. During these four months you must guard against ague, and other malarial fevers, diarrhœa, dysentery, and liver diseases.

Enteric fever is always lurking about waiting to attack us if we are careless, and its favourite haunt is the native bazaar. Cholera only visits us sometimes. Fight it as you would enteric fever. Venereal diseases and drink are unfortunately always with us, and ruin the health of more men than all the rest of the diseases put together. Numbers of our old soldiers are in lunatic asylums at home from the effects of syphilis and drink.

(1) *Enteric Fever.*—Never drink bazaar-made drinks. Never eat bazaar-made sweetmeats. Never drink milk unless you know it has been

[1] This detailing of a sufficient number of men for sanitary work only, I look upon as a matter of urgency, and I recommend it most strongly.

boiled. Be careful that the water you drink is pure. Look upon flies as carriers of the disease.

(2) *Heatstroke.*—You may get "knocked over" by the sun by day or by the heat at night. Always wear your helmet during the day. Sleep outside at night away from buildings. Never drink beer before going to bed, and never drink too much beer in the hot weather. A quart of beer in the day is enough for anyone during the hot season. More at this time of year is poison. A man who gets drunk in the hot weather plays with his life.

(3) *Diarrhœa, Dysentery, and Liver Disease.*—The first two are chiefly caused by drinking foul water or other liquid, by eating unripe or bad fruit, and especially "bulged" tinned food, and by chill during the rains. Therefore, only eat and drink what you are sure is safe and good, and avoid chill. Do not sit or loaf about in wet or damp clothes. Change at once when you come in wet with rain, or sweat, and do not get cool in your wet things, or lie down half naked. Under all circumstances keep your stomach covered, and take care your covering does not come off during the night. Abscess of the liver usually is a result of dysentery, and is provoked by chill, or drink, or both. Wear flannel next your skin. Cotton shirts when damp are dangerous; they cause chills.

(4) *Ague and other Malarial Fevers.*—Prevalent during and immediately after the rains, and caused by mosquito bites. Help the "mosquito brigade" all you can, by bringing stagnant water in or near barracks to notice, and specially if you find any mosquito larvæ in the water, or what you think may be larvæ (*i.e.*, young mosquitoes in the fish stage). Avoid chills. Sleep under properly-constructed mosquito-curtains if you can. If you get fever come to hospital at once and get quinine. It will not always be necessary to admit you to hospital. Quinine will stop your fever.

(5) *Cholera.*—When this disease is about only drink boiled water or tea. Boiling kills the germs of cholera and of enteric fever. Do not eat fruit. Do not eat or drink anything in the bazaar. Do not take to drink. Anything which upsets your inside makes you liable to get cholera, and a drunken man's stomach is a splendid breeding-ground for the germs. Do not be afraid to report sick for the slightest diarrhœa. A dose of medicine in time may save you from an attack of cholera. Live carefully, and work and play as usual.

(6) *Venereal.*—Do not get it. Is the game worth the candle? How would you like to face your people at home covered with a syphilitic rash, and perhaps your nose sunken in? Or, if you marry later on, think, you may have a wife or child reproaching you for the foul disease you have passed on to them. Remember no one who risks contagion is safe, no matter how much he may think he has made himself so. There is no necessity to give way. You can be continent and a far finer soldier than the strongest man who cannot control his passions.

(7) *Drink.*—This and venereal go hand in hand. Alcohol is not a necessity, and too much beer is rank poison. You cannot use more than 2 ounces of alcohol in your body. Each pint of beer contains 1 ounce of alcohol. Therefore a man who drinks more than a quart of beer in the day drinks to excess. He drinks a slow poison. This poison may cause delirium tremens, or abscess of the liver, or kidney disease, or, later on in life, general paralysis and insanity.

Hints to Those Who want to go out "Jungling."

(1) Always sleep off the ground if possible. (2) During and immediately after the rainy months take 3 grains of quinine first thing every morning, also sleep under properly-made mosquito-curtains if you can. (3) Avoid chills; keep your coat on when heated, and standing or sitting about; wear a flannel shirt. (4) Boil your drinking water or drink weak tea. (5) Wear a good sun-hat, and in the hot weather a spine-pad outside your coat. (6) Teetotal when shooting; anyhow, never drink alcohol before the sun goes down.

THE SUPPLY OF DRINKING WATER IN INDIA AND ITS CONNECTION WITH THE SUBSOIL WATER.

By Lieutenant-Colonel A. WILLAN DAWSON.

Indian Medical Service.

This paper is written with the object of giving a possible explanation of the outbreaks of diseases, such as enteric, cholera, &c., which sometimes occur when all recognised precautions have been taken. In India most of the water used for drinking and domestic purposes is obtained from wells, therefore a knowledge of the construction of the same, and their sources of supply, is of great importance.

Wells may be divided into two classes: (*a*) shallow, (*b*) deep. A shallow well draws its water supply from the subsoil, while in a deep or artesian well the water is obtained from below some impervious stratum which separates it from the subsoil above. By far the larger number of wells met with belong to the first class. The remainder are deep or artesian wells and should always yield good water, but often, on account of faulty construction, communication with the subsoil water and consequent contamination occurs. Sometimes the spring (artesian) water may ascend to a higher level than the subsoil water. If this be the case, water will flow from the artesian well into the subsoil, and the well water will probably remain pure; but, on the other hand, if the subsoil water level is higher (temporary or otherwise) the reverse is often the case, and if the subsoil water is impure it may pollute that in the well. Pipes used for pumping purposes are also a source of danger (*vide* Dr. G. Turner's report on the water supply to the Suffolk County Lunatic Asylum, in which two outbreaks of dysentery occurred, due to leakage in the pipes), and considerable difficulties are met with in preventing pipe leakage, and the results are always uncertain. It is therefore evident that no well water can be relied upon unless the purity of the subsoil water is above suspicion.

The direction of the subsoil water flow is usually towards some river, proceeding more or less in channels. The deepest parts form streams, which are fed by smaller tributaries, so that, generally speaking, certain areas of ground are drained by certain underground streams, much in the same way as the surface of the earth is drained. The rate of the movement of the subsoil water is slow, depending upon the nature of the subsoil, but in the so-called

streams it may travel very rapidly. Not every one appreciates the importance of, say, when troops are encamped on the banks of a river, arranging to draw the drinking water from up stream, and only allowing animals to be watered, &c., down stream, and I think it is scarcely less important to make corresponding arrangements in

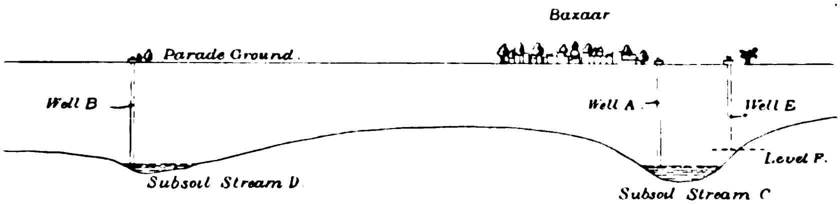

Figure 1. Showing Section of the Subsoil

regard to the subsoil water supply. Thresh takes a square mile occupied by 1,400 people, and finds the water obtained from three sides constant and free from organic impurities, but the water from the fourth side (the direction of the subsoil water flow) varied, and was often impure and unfit for domestic purposes. As most stations in India are occupied by more than 1,400 people to the square mile, wells on side of subsoil water flow are likely to be even more polluted.

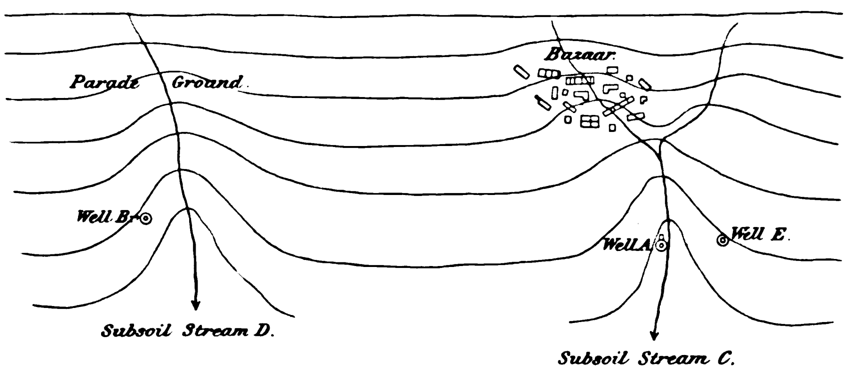

Figure 2. Showing Subsoil Drainage.

During a small outbreak of enteric in a station where I was posted the Senior Medical Officer himself analysed the water in every well. While I, unknown to him, by means of a contour map of the subsoil water of the station (fig. 2) classified all the wells as

bad, good, &c.; and his classification of the wells from the chemical examination and mine corresponded throughout. My classification was made by condemning wells receiving their supply from an impure source and *vice versa*, and I feel certain that if contour maps were made of all thickly populated areas, many wells would be put out of action with advantage to public health.

This examination of the source of water supply to a well appears to me to be of greater advantage than examining a well chemically, because the well water may sometimes be pure and at other times polluted and unfit for drinking purposes. The same applies to the before-mentioned deep or artesian wells, and it is quite possible that this temporary infection of wells is a cause of occasional outbreaks of diarrhœa, dysentery, &c.; the well water being unquestioned, because from constant use and may be occasional analysis it is thought to be pure. An instance of this is shown in well (E) fig. 1, which is a case that has come under my notice.

The well (A) receives its water supply from subsoil stream (C), the subsoil water supply of which is contaminated by a large bazaar.

The well (B) receiving its water from stream (D) is pure, and the source of supply beyond contamination, as it is protected by a large parade ground, and the country beyond is not thickly populated.

The well (E) is usually good, but may be temporarily contaminated, due to heavy rainfall; when the stream (C) swells to level (F) the water in well (E) becomes polluted.

If the ground in the neighbourhood of stream (D) was in any way fouled, it might, after a heavy rainfall, become contaminated; as a matter of fact it is not, and (B) is a constant and pure supply. Well (A) has been closed, and water from well (E) only used after being boiled.

Arrangements are being made to close (E) and convey water from (B) by means of pipes. It would therefore appear that much might be done to further improve the health of Indian stations by paying more attention to the geological formation of the ground in the vicinity of the station, and especially to the origin, course and protection of the subsoil water, and for this purpose I think that a contour map of the subsoil water, made by an engineer, and giving the rise and fall of subsoil water and other necessary geological data, should be made of every station, thus forming a basis upon which to work. A map of this kind seems to me to be as important to those responsible for the hygiene of Indian stations as a detailed map of the country is to the strategist.

Some place great faith in the purifying property of the earth, and hold that after the rain has passed through a sufficient thickness of this natural filter, micro-organisms are not found, and that the water is free from organic matter. Koch is a great adherent to this, but other authorities are equally against it in practice. The town of Frankfort derives a good water supply from the subsoil water of an extensive wood, but this wood is carefully kept free from habitation and other sources of contamination. No authority would, however, infer that you can with impunity dispose of refuse, or have bazaars, grave-yards, &c., over your origin of subsoil water; certain conditions are absolutely necessary before the subsoil water can be in any way trusted, namely (*a*) the locality must not be thickly populated; (*b*) any refuse to be disposed of must be spread over large areas and on no account put in pits; (*c*) there must be a *living* surface, and on no account must this be removed; (*d*) the porous filtering subsoil must be of a sufficient thickness; if too thin, then its purifying power by oxidation and filtration is limited, and the rise of the subsoil water must, on this account, be known. Here also it is important to know the character of the filtering media. If of a sandy nature, purification can take place by virtue of oxidisation assisted by periodic flushing; on the other hand, if the subsoil contains much clay, especially black clay in which there is a large percentage of organic matter, such a process of purification is impossible, and we have, in fact, a culture medium. Now, we cannot know that these necessary conditions exist unless a thorough examination of the ground has been made, and therefore the importance of a thoroughly reliable map. Caution must be exercised when reliance is placed upon the purifying property of the soil, especially if the characteristics be unknown, for the soil is, after all, a filter, and all filters, whether artificial or natural, are treacherous, and are a source of danger if not constantly attended to by some competent person. One must also be always on the look-out for the formation of fissures, which may occur at any time, and at once destroy one's filter, especially in view of the fact that impurities may travel long distances in fissures without undergoing oxidation or change. For example, the cause of the epidemic of enteric at New Herrington was traceable to a drain three-quarters of a mile away, and due to a fissure in the subsoil stratum. The above applies to subsoil water, but it is also important to know all about your collecting surface of the supply to deep or artesian wells; if far away the water will probably be pure, but if within a few miles the collecting

surface ought to be protected. Especially is this the case if the soil is very porous or fissured. Another source of pollution to be carefully guarded against is the presence of disused wells, which are often used by natives for insanitary purposes. Should these wells be situated on the up-stream side of the station, they obviously are a source of great danger, and clearly shew the necessity of keeping all the wells over the source of the water supply under rigid supervision. That subsoil water ought to be protected can be seen from the following list of waters, arranged according to purity:—

(1) Deep spring water; (2) deep well water; (3) upland surface water; (4) moorland water; (5) subsoil water (distant from aggregation of houses); (6) land springs; (7) river water; (8) subsoil water (under villages and towns).

In conclusion, I would quote the following from Thresh, which I think applies even more forcibly to India: "Notwithstanding the immense progress which has been made in this country in recent years in practical sanitation and sanitary administration, outbreaks of preventable diseases, due to pollution of water supplies, have been all too frequent. Common-sense suggests that if it is desired to obtain a pure supply of water a source should be selected removed as far as possible from any contaminating agencies, and every reasonable precaution which science or experience can suggest should be taken to prevent either wilful or accidental pollution."

I certainly think that much might be done in India to further the progress made in recent years by studying more minutely the geological formation of our stations, and by paying special attention to the direction of flow, &c., of the subsoil water. Maps should be made by engineers, supplying all necessary information, and be issued to standing barrack committees and district municipal boards, &c.; and when land is selected by them for building or entrenching purposes, &c., due consideration should be given to the direction of the flow of the subsoil water, and entrenching grounds should always be put on the down-stream side of the subsoil water supply to a station. If the nature of the ground or the want of space prevents this being carried out, then those wells receiving their water supply from areas liable to pollution should be closed, and the water supply drawn only from wells which are not open to any possible source of contamination.

AN OPERATION FOR LIVER ABSCESS.

BY CAPTAIN A. J. HULL.
Royal Army Medical Corps.

THE object of the following operation is to provide an efficient procedure for the treatment of liver abscess, without the danger and inconvenience of an open incision.

Instruments.—A cannula with a fine exploring needle brazed to its side. Both the cannula and needle should be provided with stopcocks. It will be found convenient to have several of these combined instruments in varying sizes. The instrument simply forms a two-way cannula. Two cannulas, or a cannula and an exploring needle, taken from an ordinary case, may be used in an emergency.

Operation.—The abscess is sought for in the usual way. I use an ordinary fine exploring needle, and not the trocar and cannula supplied in aspirating cases, which are usually used. I find that the simplicity and fineness of a needle more than compensate for the occasional blocking of the needle which occurs. Having found the abscess, I use the needle as a guide, and push in the two-way cannula which I have described. This is no larger than the instrument used for exploring by the majority of operators. The pus is then aspirated by connecting the cannula with an exhaust bottle, the tap of the needle being closed. Sterilised water is then injected through the needle, and aspirated through the cannula. A solution of peroxide of hydrogen, equal in quantity to one-fourth of the amount of pus withdrawn, is then injected into the cavity through the needle attached to the cannula. Whilst the solution is being injected the cannula is left open. Immediately the solution has entered the cavity the tap of the needle is closed, and the solution aspirated through the cannula. I then half fill the cavity with hydrogen peroxide, and leaving the stopcocks open, allow the solution to remain in the cavity for ten minutes; moving the patient in order that the antiseptic may come in contact with the entire surface of the abscess wall. The contents are then aspirated, and the cavity again filled with a diluted solution of hydrogen peroxide. The operation is then complete, the instrument is left in the puncture, and both the taps are left open. The strength of the solution used is a ten-volume solution of peroxide

of hydrogen. The solution is heated to the temperature of the body before being injected.

After-treatment.—The patient may either be treated by continuous irrigation, or by repeated washing out of the cavity. By either of these methods the abscess cavity will be most effectively drained and disinfected, without inconvenience to the patient. The choice of method depends upon the condition of the patient, the character of the abscess, and the nursing and supervision available.

Continuous Irrigation.—A douche is placed above the patient's bed, and connected with the irrigating needle by a tube. A tube is attached to the cannula and carried into a basin of lotion beneath the patient's bed. When the taps of the two-way cannula are turned on, a stream of warm fluid will slowly pass through the abscess cavity. The douche is placed only a few inches above the patient, as very little pressure is required. Peroxide of hydrogen must not be used for continuous irrigation, on account of the gas generated.

Repeated Irrigation.—This is carried out in the manner described under operation, by injecting and aspirating an antiseptic several times during the day. In order to accommodate the length of the two-way cannula to the contraction of the cavity, the cannula is withdrawn a short distance at intervals.

Dangers of the Operation. Bursting of the Abscess.—This may occur if too large a quantity of fluid is injected. Blocking of the cannula when fluid is entering the cavity by the needle may also produce this result. This accident will not occur if the fluid is injected slowly by means of a douche, and care is taken that the cannula is clear. The rapid accumulation of gas, due to the liberation of oxygen, may cause danger if the solution is too strong, the cannula is blocked, or too large a quantity of peroxide has been injected. Large abscesses suspected of being near the point of bursting are unsuitable for treatment by peroxide of hydrogen. Some other non-poisonous antiseptic must be chosen. Measurement of the pus withdrawn is an absolute guide to the amount of fluid which may be injected.

Collapse.—If the patient is carefully watched, and the strength and temperature of the solutions injected are correct, this will not occur.

Advantages of the Operation.—The shock of a major operation is avoided. A general anæsthetic need not be given. The patient is saved the dressing of a large discharging wound. The patient's strength is conserved. The operation being a safe and easy one,

it will not be feared by operator or patient, but will be performed at an early stage. The danger of infection of the wound is avoided. It is well known that pus-forming bacteria or cocci are not found, as a rule, in the pus originally withdrawn; but they are almost invariably found in the wound after an incision. The wound is cleanly and efficiently drained.

The following is a brief extract of two cases successfully treated by this method, under totally different conditions.

M. L., aged 30. A native of Africa. This patient was operated upon in 1902. The patient apparently suffered from an abscess of the chronic variety; no history was obtainable. The physical signs being well marked, a needle was inserted in the eighth space, and twenty ounces of liver pus drawn off. Having at the time no two-way cannula, I used two ordinary cannulas fixed together with wire; and in the absence of peroxide of hydrogen I used a diluted solution of tincture of iodine irrigation. The cavity was washed out with this solution in the manner before described, and then washed out with sterilised water. The cannulas were left in the wound and a dressing applied. Six hours later I again filled the cavity with diluted iodine solution, and irrigated. On the following three days I repeated the irrigation treatment three times a day. On the fourth day the tubes were removed and the patient made an uninterrupted recovery. He was at work in the fields a fortnight after the operation.

Mr. E. F., aged 42. This patient was seen with Dr. Bryant in London in October, 1903. The patient had lived in Egypt for many years, and had suffered from chronic dysentery. He sought advice for continuous fever and general debility. There being no definite physical signs, an examination of his blood was made, and the presence of leucocytosis discovered. Under ether, the patient's liver was explored. I made several punctures, with negative results, but ultimately drew off an ounce and a half of liver pus through a puncture in the eighth space. This abscess was irrigated with sterilised water, and again aspirated. It was then treated with peroxide, and again washed out with water. The after-treatment consisted in the continuous irrigation with sterilised water at a temperature of 99° F. On the evening of the operation the cavity was again washed out with hydrogen peroxide. On the following evening the patient's temperature being 101° F., the liver was again explored; at the fourth puncture, which was in the nipple line immediately below the costal margin, and directed obliquely upwards, an abscess contain-

ing three ounces of pus was discovered. A second two-way cannula was introduced, and the cavity treated with peroxide solution, as in the case of the first abscess. Both the abscesses were then irrigated daily for three hours with sterilised water at a tempera- of 99° F. After four days of this treatment the tubes were removed. The patient recovered fairly rapidly, being delayed somewhat by an attack of pleurisy.

Since writing the above I find that Major Rogers and Captain Wilson, I.M.S.,[1] have published a most important paper on the treatment of amœbic liver abscess. Major Rogers found that the amœbæ in the wall of the abscess could be killed with great rapidity and certainty by quinine in weak solution. On this account he recommends that the pus shall be aspirated and quinine solution injected. Several cases have been operated upon successfully by Captain Wilson by this method. It would be impossible to over-estimate the value of Major Rogers' and Captain Wilson's work. It should revolutionise the treatment of liver abscess, and result in an enormous reduction in the mortality.

In future, I propose adopting Major Rogers' recommendation as regards the use of quinine, and I shall inject it through a two-way cannula, which will be left in the wound as long as pus continues to be washed away by the irrigating solution. The most important point in the treatment is to arrive at an early diagnosis by means of blood examination and X-rays. It is unnecessary to wait for physical signs to appear; exploration, if performed properly, is harmless. It will be noticed that Major Rogers, finding that a liver abscess usually contains no pathogenic bacteria or cocci, considers it unnecessary to drain by an open wound, as quinine will kill the amœbæ. On the other hand, it was my endeavour to drain and sterilise an abscess cavity, whatever the nature of its cause may have been, in a safer and more efficient manner than by an open incision. It will probably be found that deep abscesses other than liver abscesses are equally amenable to this treatment.

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[1] "Two Cases of Amœbic Abscess of Liver," *British Medical Journal*, June 16th, 1906. Major Leonard Rogers and Captain Wilson, I.M.S.

THE "ALLIES" OF ENTERIC FEVER IN INDIA.

By Lieutenant-Colonel S. GLENN ALLEN.
Royal Army Medical Corps.

Although it will become sufficiently apparent during the course of this paper what I mean by the "allies" of enteric fever, it may nevertheless be useful to indicate at the outset in what sense the term is here employed.

Definition.—By the "allies" of enteric fever I mean all agents—whether animate or inanimate—through whom, or by means of which, the importation, existence, multiplication and conveyance from man to man of the specific germ is, or is capable of being, facilitated, fostered or favoured. I am, no doubt, taking a certain amount of liberty with our language in applying this term to agents whose assistance is neither voluntarily nor consciously given, and which are not, indeed, in any sense friends or well-wishers of the power whose strength, nevertheless, they constitute. It is this last-mentioned fact, however, that has led me to select the word "allies" as an appropriate designation, inasmuch as it emphasises the importance of the relationship that exists between enteric fever and certain agents of infection. Indeed, if we but think, it will be evident to us that the whole power of the disease and the real difficulty of solving the enteric fever problem that faces us to-day lies in the fact that certain potential "allies" of the disease are in existence to a greater or lesser extent in all our military cantonments. "Allies" they are, in point of fact, although not so consciously or by intention. Indispensable "allies," moreover, as deprived of their services, the *Bacillus typhosus* would be scarcely more formidable than is the hay bacillus, dependent as it is on them, not only for the means of reaching its victims, but for its very existence. In one way this is fortunate, as, were this not the case, enteric fever would not be classed as a preventable disease. Being so, however, it follows that the whole "art of sanitation" (as regards disease prevention) consists, *firstly*, in detecting the nature of these potential "allies"; and *secondly*, by this means or that, making it impossible for the disease to avail itself of their services in the future. It is no doubt true that among the number are some (chiefly connected with climatic conditions) which are

beyond our control. But they are neither numerous nor important, so need not detain us here. The great majority are quite within our power to remove or control, which is but natural, seeing that they are of our own providing, or the natural result of our methods of sanitation, or our mode of life.

It is not my intention to attempt to give a full list of these agents of infection; even were I in a position to do so, the detail would prove long and wearisome. I only propose to consider a few of the most important "allies" which have come within the range of my own experience. Although numbering but seven in all, they seem to me quite sufficient in themselves to account for the small measure of success with which the efforts to stamp out enteric fever have been rewarded—at any rate, so far as the Punjab is concerned. The "allies" of enteric fever which I have particularly in my mind are, as I have said, seven in number, and for descriptive purposes I shall designate them:—

First "ally."—The unsuspected germ-carriers.

Second "ally."—The hill battalions and batteries.

Third "ally."—The standing camp.

Fourth "ally."—The common fly (various species).

Fifth "ally."—The multiple small cookhouses.

Sixth "ally."—The bazaar-town within cantonments.

Seventh "ally."—The dry-earth latrine, plus night removal of excreta and shallow trenching.

First "ally"—Unsuspected Germ-carriers.—I have given this class of "ally" the first place, as the very fact that they are so generally overlooked as possible sources of infection makes them all the more important. We are now quite alive to the fact that enteric fever convalescents may remain sources of danger to others for a long time after perfect recovery from the symptoms of the disease. Segregation camps for such patients—first installed, I believe, by Lieutenant-Colonel T. P. Woodhouse, R.A.M.C., at Ambala—are now general. We appear, however, to have overlooked another important fact, equally well established, viz., that those who have been in attendance on enteric fever cases may become infected with the specific germ without even having, or ever having had, the disease themselves. This is an especially important point to bear in mind in India, because the rank and file of the Royal Army Medical Corps do not serve here, and the male nurses in the military hospitals are men selected from the various regiments and batteries of the garrison. These men are not permanently employed as hospital orderlies, but return to duty from

time to time. It is not uncommon for several of these regimental orderlies to be employed in the enteric fever ward for weeks or months. Is any precaution ever taken to guard against their returning to their various units as very efficient, though unconscious, "allies" of the enemy against which they have been battling in the hospital wards? Personally, I have never even heard the suggestion made that such a danger existed. But it appears to me that no man who has been employed in nursing enteric fever cases should be allowed to return to his regiment without it being at least ascertained that he is free from bacilluria. Whether urotropine, or some similar drug, should not be given as a precautionary measure, is a matter for individual judgment. The answer will be "yes" or "no," according to individual faith, or lack of faith, in these germicides. In addition to the orderlies there are the nursing sisters; although the danger of their becoming innocent "allies" of enteric fever, or, at any rate, propagators of infection, is not so great, yet it must not be overlooked. In what way this unconscious but possible alliance can be detected and guarded against is such a difficult and delicate question that only a very senior and experienced officer (or an extremely junior and inexperienced one) could venture to offer an answer. I, therefore, content myself with pointing out the danger, and pass to the consideration of "ally" No. 2.

Second "ally"—Hill Battalions and Batteries.—In the Punjab the sensible custom now prevails of sending as many of the British troops to the hills for the hot weather as possible. There are some battalions and batteries that actually belong to hill stations, but are always brought down to the plains for the cold months. It cannot, however, be denied that the one objection to this practice lies in the fact that enteric fever is not infrequently contracted by some individual on the march, and an epidemic started at the station to which they return. I have had occasion to review the enteric fever records at Ambala for many years past, and I have found sufficient evidence to prove that imported infection was a not infrequent cause of many outbreaks in the past. I found that there was a rise in the enteric fever curve at the commencement of each cold season, which reached its maximum in December, a second well-marked rise taking place in April, and attaining its maximum in May. The first rise was certainly due to imported infection by hill battalions and batteries; the second rise being due to other causes which I need not go into now. Regulations to guard the soldier against the risk of contracting

enteric fever on the march down from the hills have recently been introduced. The only sure safeguard to preserve the station from this danger would be the detention of all returning units in observation camps on the outskirts of cantonments for at least fourteen days. A period of quarantine should certainly be compulsory as regards any battalions or batteries which have actually suffered from the disease during the rains.

Third "ally"—The Standing Camp.—Although it is not, I believe, the rule in the Punjab to keep the hill battalions and batteries under canvas during the winter, the practice still obtains at Ambala owing to lack of accommodation. That the conditions of camp life are especially favourable to the spread of enteric fever is, I take it, generally admitted, and that our standing camps were great factors in causing the excessive prevalence of the disease at Ambala I have elsewhere given reasons for believing. I advocate the construction of winter quarters at all plain stations where the hill units are under canvas, as I feel sure it would deprive enteric fever of an important "ally."

Fourth "ally"—The Common Fly (various species).—I have placed this pest of warm climates next to the standing camp, because the camp latrines, cookhouses, &c., have always, as far as my observation goes, a stronger attraction for flies than those of the adjacent permanent lines, although the sanitary supervision is rather more strict, as a rule, in camps than in barracks. It may be that flies find it easier to gain access to the flimsily-constructed camp latrines and cookhouses than to those of the permanent lines. If so, it is another reason for abolishing these standing camps, as the dangerous alliance that often exists between enteric fever and flies cannot reasonably be questioned. When lecturing to non-commissioned officers and men of the "regimental sanitary cadres" and others, I am in the habit of impressing upon them that the really dangerous "animals" of India for the white man are the common fly and the (only too numerous) mosquito; not snakes, scorpions, &c. Indeed, I think a useful text wherewith to adorn the walls of barrack rooms, messrooms, cookhouses, &c., might run as follows :—

> "The fly is more dangerous than the scorpion;
> The mosquito than the cobra"—

as it would impress upon all the necessity for waging war on these great "allies" of disease.

Fifth "ally"—Multiple small Cookhouses. — When making sanitary inspections of barracks or camps in India one cannot fail

to notice the extraordinary number of cookhouses belonging to each unit. Not only has each company in a battalion a cookhouse to itself, but the sergeants' mess, the coffee shop, and the Royal Army Temperance Association room also. In small units, such as mountain batteries, it is often worse, as a cookhouse for each section, a fourth for the coffee shop, and yet another for the sergeants' mess is not considered excessive. A strictly enforced company latrine system is an undoubted safeguard against the spread of enteric fever, whereas this company and section cookhouse system adds to the difficulty, especially in the hills, where space is limited, of keeping latrines and cookhouses at due distance from each other, and certainly increases the chances of food contamination. Indeed, there are so many objections to the multiplication of small cookhouses, both on sanitary and economical grounds, that I am surprised military sanitary officers in India do not set their faces against them. By doing so enteric fever would be deprived of a good many potential "allies."

Sixth "ally"—The Bazaar-Town within Cantonments.—Although we cannot get rid of native bazaars within cantonments altogether, we could, with advantage, dispense with (what I call) the bazaar-town, which is often, in fact, a native city of many thousand inhabitants masquerading under the modest name of the "Sudder Bazaar." These overgrown bazaars must offer numerous facilities for breeding the *B. typhosus*, and once they have been allowed to spring up it is almost impossible to get rid of them. As Ambala Cantonment offers a striking object lesson with regard to this particular evil, perhaps the following short sketch of its past history may not be out of place:—

The military station of Ambala, *i.e.*, Ambala Cantonment, is so generally called "Ambala," that most people suppose they are one and the same place.[1] As a matter of fact, Ambala is an ancient native city, dating back to the fourteenth century; the cantonment, (comparatively) a thing of yesterday, having been first opened in 1843. For sanitary reasons, presumably, the authorities of the day avoided the native city and selected a virgin site for the cantonment four miles to the south-east. While they thus wisely kept the soldier away from the city, they, unhappily, did nothing to prevent the city coming to the soldier; consequently, we have to-day a native town of 25,000 inhabitants existing within cantonment limits,

[1] It is a remarkable thing that even Rudyard Kipling confuses the two places together in his book, "Kim."

which offers many facilities for the cultivation of the specific germ of enteric fever. Regulations are now in force to prevent further growth of the town and population, and the strictest sanitary supervision possible is exercised, but we cannot do much now to deprive enteric fever of the services of the powerful "ally" which has been provided for it by lack of sanitary foresight. Elsewhere, however, at places where these bazaar-towns are still only in their infancy, stringent measures should be taken to keep them within due bounds.

Seventh and last "ally"— The Dry-Earth Latrine, plus Night Removal of Excreta and Shallow Trenching.—That a dangerous alliance is liable to be formed between enteric fever and our dry-earth conservancy system is now so generally admitted there is no need to do more than mention the fact here. While all are agreed as to the necessity for a change, there is considerable diversity of opinion regarding the nature of the change that should be introduced. That it must be in the nature of reform, not of a revolution, will, I think, be generally accepted by practical sanitarians. Further, the reformed conservancy system must comply with the following conditions if we are to hope for its acceptance :—

(1) It must safeguard the community from the present danger of spreading enteric fever by means of latrine infection, or by fly- or dust-borne contagion from trenching grounds; (2) it must not entail great increase of expense, either in the way of initial outlay or in its working.

Personally, I feel convinced that dangers of our present conservancy are due to :—

(1) The use of the so-called dry earth in the pan; (2) night removal of sewage; (3) the Thornhill system of trenching.

Having recently described, in a letter to this Journal,[1] a scheme embodying reforms as regards these three particulars, I shall not repeat myself here, but submit, in conclusion, that whatever drawbacks it may possess, it would at any rate sever once and for all this dangerous alliance, one of the great sources and causes of enteric fever amongst the British troops in India.

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[1] Vol. vii., December, 1906, p. 633.

Clinical and other Notes.

ORIENTAL SORE.

By Lieutenant-Colonel J. D. RECKITT.
Royal Army Medical Corps.

A residence of a year and a half at Mooltan, in the Punjab, has necessarily made me fairly familiar with this troublesome and often obstinate form of ulcer, and although I have not been able to satisfy myself that it is caused by any specific germ, yet what is very much to the point from a practical point of view is the good result attending its treatment by the continuous application of a simple antiseptic poultice, and which readily brought about a cure in every case that came under my care.

When I arrived at Mooltan in March, 1905, several cases among Europeans came under my observation. Some were of recent and others of long standing, and the ulcers were either on the dorsal aspects of hands and fingers, or on the legs and ankles. From their appearance, it occurred to me that the simple method of trying to bring about healing from the bottom and undermined edges was the proper way to deal with such sores. With this object I personally dressed my cases in the following way: Three layers of lint, about a quarter of an inch larger than the ulcers, were well soaked in 1 in 60 carbolic lotion, and after the ulcers had been carefully washed with hot carbolic lotion, the layers of lint were applied, and over them a piece of gutta-percha tissue, about a quarter of an inch larger than the uppermost layer of lint and carbolised, then a layer of carbolic or boric wool, and the whole secured by a bandage. Special instructions were given to the patients not to disturb the dressings and to rest the parts as much as possible. The poultice was repeated daily until healing was complete, and in no case was there any recurrence. The average time under treatment was from ten days to about a month.

I believe the good effect of such simple treatment to be due to the constant contact of the *moist* antiseptic with the ulcerated surface, to its stimulating effect upon the unhealthy granulations, and to the prevention of the formation of the crusts beneath which germs thrive. The important point to bear in mind, I believe, is to maintain the moist antiseptic in continual contact with the ulcer until healing is complete.

A SUGGESTED IMPROVEMENT IN THE FORM OF NEEDLE USED FOR INTRAMUSCULAR INJECTIONS OF MERCURY.

By Lieutenant-Colonel W. J. BAKER.
Royal Army Medical Corps.

One drawback connected with intramuscular injections is the possibility of the needle breaking during its introduction, with the result that the fractured end may become buried in the muscular tissue, necessitating a considerable operation for its removal. Though this accident is, fortunately, of rare occurrence, still it does occasionally happen, and the sufferer can then scarcely be expected to go among his comrades advocating intramuscular treatment.

In a few instances, when the point of the needle has become blunt from use, when an extra tough skin is encountered, and considerable force has been exerted to drive the point through the skin, the needle, especially if a long, slender one, may buckle and break, usually somewhere about its centre. In these cases the fracture, as a rule, occurs just as the needle has passed through the skin, and there is usually no difficulty in removing the fragment. In by far the greater number of instances, however, the break occurs immediately at the line of junction of the needle with the shoulder of the syringe, this being a fixed point and subject to the greatest strain; and the break is especially liable to occur if the patient should suddenly contract his muscles when the needle is fully inserted. When this accident happens the skin will probably retract over the fractured end of the needle, and though immediately cut down upon it may be impossible to find it. In one instance where this was done, and where the needle was subsequently localised by X-rays, two further operations were performed without success, and the man is still in possession of the needle.

To guard against this accident, I have had a needle made with a very small shield, curved slightly backwards and fixed to the needle close up to the shoulder, there being a merely perceptible space of about one-fifteenth of an inch between the shoulder and the back of the shield. The weak point of the needle still remains at the shoulder, but should the needle break at this point the shield will prevent it from slipping through the skin and becoming lost in the muscular tissue, thus avoiding the often serious consequences of such an accident.

CASE OF SUICIDE BY MEANS OF A BLANK ROUND OF AMMUNITION.

By Captain T. H. STEVENSON.
Royal Army Medical Corps.

Corporal S., Royal Irish Rifles, was brought to the Station Hospital, Fyzabad, at 6.30 a.m., having, in the barrack-room, shot himself with his rifle about fifteen minutes previously. He sat on the edge of his bed,

placed the muzzle of his rifle in his mouth and pulled the trigger by pressing with his foot on a piece of stick wedged against it. He was slightly conscious, and bleeding profusely from his mouth. His clothes were saturated with blood, of which he had evidently lost a large quantity. I saw him ten minutes after his arrival; he was then almost unconscious.

On examination, a large wound was seen in the roof of the mouth, and the superior maxillæ were separated by a wide fracture in the middle line of the palate. The left superior maxilla was freely movable, being fractured in every direction, through nasal and orbital cavities and malar bone. The superior maxillæ were approximated and wired together, and the large cavity in the palate plugged. Hæmorrhage stopped and patient rallied somewhat under treatment and made attempts to speak, but was never intelligible. He relapsed shortly afterwards into unconsciousness, gradually sank, and died at 12.45 noon.

At the *post-mortem* examination it was seen that the whole of the soft palate had been blown away, and, in addition to the extensive shattering of the superior maxillæ, there was a longitudinal fracture running through the cribriform plate of the ethmoid and the sphenoid. There was no laceration of the brain substance, merely some slight congestion and a few small hæmorrhages.

The case is reported as of interest in showing the tremendous explosive power of a blank charge of cordite fired into the mouth.

REPORT ON THE TREATMENT OF SCABIES WITH BALSAM OF PERU.

By Lieutenant-Colonel S. C. B. ROBINSON.
Royal Army Medical Corps.

My attention was particularly turned to the treatment of scabies owing to the absence of any special wards for the segregation of cases of this disease in the Military Hospital, Colchester. This causes much inconvenience during the winter months, when these cases are fairly numerous.

When the "Third Report of the Advisory Board for Army Medical Services on the Treatment of Venereal Diseases and Scabies" appeared, my eye was caught by a method of treatment in use in the German Army and described on page 9 of the Report. This procedure, which consists in rubbing the patient with balsam of Peru and then returning him forthwith to duty, struck me as being at once simple, efficacious, and so well suited to my requirements, that I determined to give it a thorough trial.

Since December 20th, 1905, thirty-seven cases of scabies have been treated with balsam of Peru after the manner about to be described, and it has proved so satisfactory that I now never think of treating the cases in any other way.

Technique.—On admission the patient is given a hot bath and thoroughly scrubbed by the ward orderly, who is instructed to spare neither soap nor patient. He is then dried quickly, and the orderly *at once* rubs him over with the following preparation:—

Balsam of Peru	Three parts.
Glycerine	One part.

The balsam is applied to the whole body with an old nail-brush, soft from long usage, and well rubbed into the flexures and crevices of the skin. He dresses in clean clothes and remains in hospital till his own bedding and clothing are disinfected (usually three days); he is then discharged to attend once a week for a month at the hospital for observation. A register of his attendance is kept, and he is warned not to take a bath till ordered by the medical officer. The patient should not be allowed to bathe till four weeks have elapsed, *i.e.*, until he is free from all danger of a relapse. Should there be any subsequent return of the itching, which is unusual, the man is detained for a day, bathed, and has a further application of the balsam to the itchy parts.

The most striking result of this treatment is the immediate cessation of the itching after the first application. Many patients complain that the irritation has prevented their getting any sleep for some time before admission, but they invariably state, if asked, that they have slept soundly on the night of admission and subsequently. One rubbing usually suffices, but occasionally a second or even third application is required to certain parts in which there may be a slight return of the itching; this is generally due to the man having taken a bath before his four weeks have elapsed, or to carelessness in carrying out the original treatment.

The essentials of success are mainly these, viz.: *The patient must be thoroughly scrubbed by the orderly;* it is courting failure to leave this or the next step to the patient. Secondly, the preparation must be well and conscientiously rubbed into the skin *all over* with a brush *immediately after the man has dried himself. Lastly, the patient must not have a bath till four weeks after the first application.*

If the responsible medical officer will carefully instruct his orderly in this simple technique, and see that it is properly carried out, I am confident that he will find this treatment as satisfactory and efficacious in his hands as it has been in ours, but any carelessness in applying these simple rules spells failure. When the patient has been properly rubbed over, the skin, for several days after the application, has the appearance of having been varnished.

Remarks.—When first initiated the results of this method of treatment were not at all encouraging; relapses were frequent, though the patient at once improved again after admission, and I was on the point of abandoning it, when it was fortunately discovered that our failures were due to too frequent bathing of the patients, a point overlooked in the Report.

Major F. J. W. Porter, D.S.O., to whom I am indebted for this

discovery, and also for perfecting the technique of the treatment, had a case under his care in the Detention Barracks, which made no progress in spite of the almost daily application of the balsam. He was much struck by the failure of the treatment, and on making an exhaustive enquiry found that the Chief Warder had ordered the man to have a bath daily. Thinking this was possibly the cause of the lack of success he ordered the baths to be discontinued, and the man rapidly recovered. The same thing occurred in hospital when there has been a change of orderly, and when a man attending has had baths before his period of prohibition has expired.

Further, in none of the thirty-seven cases treated has any subsequent dermatitis been observed.

I may add here that the pure balsam as used in Germany was not found to be so satisfactory as the mixture described above.

INCONTINENCE OF URINE IN THE SOLDIER.

By Lieutenant-Colonel C. C. REILLY.
Royal Army Medical Corps.

The article by Lieutenant-Colonel Glenn Allen, R.A.M.C., in the October number of the Journal for 1906, under the above heading, was of much interest to me.

It is possible that the station to which Lieutenant-Colonel Allen refers is Malta. During a short period of service there, as far as my memory goes, more cases of "bed-wetting" came under my observation than have done so at any other station, and what is particularly noteworthy is that they sometimes seemed to occur in groups. The admission of one case would be followed by the admission of one or two more within a week. The opinion I formed was, that either there was some malingering, or, what was more likely, that cases of this sort at their duty were encouraged by the admission of one of their number to report "sick."

I remember that, in the majority of cases, no pathological cause could be discovered for this conduct, nor were any remedial medical measures of benefit. Disciplinary and moral means seemed to be of most avail, as is the case in other bad habits. I must confess that the total output of urine was not measured, as Lieutenant-Colonel Allen suggests, but if there were polyuria, it was not referred to by the patients, the complaint being generally that of "wetting the bed," and it seems to me that, unless the amount of fluid imbibed is also measured, it is a mistake to come to the conclusion that the apparent polyuria is truly such.

To me it has appeared as a physiological rather than as a pathological act. The average soldier is a most thirsty individual—it seems to be

inherent in the class from which he is mostly recruited. I do not refer necessarily to alcoholic consumption; but that he imbibes an extraordinary amount of fluid, I think any one who likes to investigate by a few questions will readily discover. Regimentally manufactured aerated waters are very cheap. From personal enquiries I have ascertained that with a very large proportion of the rank and file it is quite a common occurrence to rise once or twice for the purpose of micturating after retiring to bed, and this among young men presenting no symptoms of disease likely to cause such a habit and not reporting sick on this account. So common has been my experience in this respect, that it has ceased to be a matter of surprise, though, at the same time, from enquiries made among other than the rank and file, it has proved quite the exception. With these facts as our data it is not difficult to realise how, in the case of exceptionally lazy or heavily sleeping individuals, this so-called incontinence of urine may occur.

The treatment I have found most successful with these cases was abstention from all drinking for the two hours preceding bedtime, and the rousing of them at midnight for the purpose of micturition. After a reasonable time, if the patient be willing to do his best to break the habit, this rousing, if the necessity for it still continues, becomes automatic, and the nuisance and damage is obviated.

A RECENT INVASION OF THE "CHIGGER" IN THE ANGLO-EGYPTIAN SUDAN.

By Captain HOWARD ENSOR, D.S.O.
Royal Army Medical Corps.

The "chigger," or sand-flea (*Pulex penetrans*), which has shown itself so energetic a colonist in Africa, having first been introduced from tropical America in the early seventies of the last century, is still rapidly covering more ground, and will probably, before many years have elapsed, gain access to every part of the continent where the climatic conditions are favourable to its existence.

Until lately this pest was unknown in any part of the Anglo-Egyptian Sudan, but it has now firmly established itself in the south of the Bahr-el-Ghazal Province along the line of the Anglo-Egyptian and Congo Free State frontier. It has, in all probability, been introduced into the Bahr-el-Ghazal from the Congo Free State, where it is very prevalent, having first probably been carried there by this State's native troops, who are, or rather were, recruited in great part from the West Coast of Africa, where "chiggers" first made their entry into Africa, and where they have been abundant ever since.

I have been informed that "chiggers" were first noticed among our Sudanese troops stationed on the frontier about eighteen months ago, and

since then these unpleasant little insects have been steadily on the increase, causing, as a result, numerous admissions to hospital, thereby temporarily incapacitating many men from duty. At present "chiggers" only exist in the southern frontier stations, no cases of admissions to hospital having occurred from stations near the Bahr-el-Ghazal and French Congo frontier, or from the various stations in the interior of the Province.

The "chigger," of course, is described in every work on tropical diseases, but as it is only in tropical Africa that this pest comes under the observation of officers of the Royal Army Medical Corps, perhaps a short description of the flea, together with the treatment we have found most successful here, may be of interest.

"The 'chigger,' both in colour and appearance, is very like the common flea, and like it, lives chiefly in the dust on the floors of dirty houses, stables, &c. The female flea, however, when impregnated, takes the first opportunity of burrowing under the skin of any warm-blooded animal; in man, the position selected is usually the skin between the toes and that over the bases of the nails, but she will, as occasion offers, introduce herself under the skin in any part of the body. When safely established the 'chigger' feeds on the blood of her host, and rapidly increases in size as gestation progresses, and when this is completed a tumour about the size of a small pea can be seen surmounted by an orifice which is blocked by the posterior segment of the 'chigger.' The ova are then expelled, a thirteen-ringed larva being hatched out of each egg. This larva soon encloses itself in a cocoon, from which a perfect insect emerges after from eight to ten days" (Manson). When all the eggs are laid, the skin over the insect breaks down and she emerges potent, when again impregnated, for further mischief. In this way a small ulcer is caused by the breaking down of the skin over the "chigger," and as several such ulcers may co-exist, it is easy to imagine that many men are constantly being incapacitated from duty in a station where "chiggers" abound, unless the men are carefully examined at regular intervals, and the "chiggers" extracted before they have had time to cause ulceration.

The treatment consists in not allowing the insects to proceed to ovulation, and in consequence to cause ulceration, but to extract them by enlarging the points of entrance in the skin by means of a tiny incision, and then removing them with a sharp needle. This should be done as soon as the insect makes its presence known to its host by the irritation excited by its gradual increase in size consequent on the commencement of gestation. The small operation described above can be quite efficiently carried out by any intelligent orderly, provided the importance of doing it antiseptically has been impressed upon him. After the "chiggers" have been extracted boric acid powder should be dusted on the tiny wounds, and the wounds then dressed aseptically. The dressings should not be

disturbed for three days, at the end of which period the wounds will, in the vast majority of cases, be found to be entirely healed. There is no necessity to admit such cases to hospital, and they can perform all ordinary duties. Neglected cases, however, which have gone on to ulceration, must be admitted and dressed daily until the ulcers are soundly healed.

With regard to the prevention of the attacks of "chiggers," all that can be done is to instruct the men as to the cause, and to insist, as far as possible, on their wearing their boots, always a matter of difficulty, however, with black troops, who all, as a rule, prefer to go about barefoot when off duty. Orders as above have been issued to all medical officers in charge of stations which are infected with "chiggers," and it is hoped that as a result the number of admissions from this cause will diminish. In order, if possible, to prevent "chiggers" being carried to stations so far free from them, all troops, carriers, &c., are examined before proceeding from an infected station, and only those who are quite free from "chiggers" are allowed to proceed. It is to be feared, however, that it will only be a question of time before "chiggers" become common everywhere in the Bahr-el-Ghazal, and will eventually extend northwards to Khartoum and Omdurman, and from thence to Egypt, having first extended throughout the whole of the Anglo-Egyptian Sudan, the climatic and telluric conditions of which are especially adapted for the extension of these pests. It will, I fear, be impossible to effectually guard against such an invasion, as, although troops can be kept under observation and cleanliness enforced, it is obviously impossible to prevent "chiggers" being carried, and being allowed to multiply, by the native population.

A CASE OF MALARIAL FEVER.

By Captain HOWARD ENSOR, D.S.O.
Royal Army Medical Corps.

Private M. D., a soldier of the 9th Sudanese Regiment, was admitted to the Station Hospital at Wau, Bahr-el-Ghazal District, from the hospital detention room, on July 21st, 1906, suffering from what appeared to be an ordinary attack of malarial fever.

On admission his temperature was normal, but as his morning and evening temperatures during the previous day in the detention room had registered 103° F., he was admitted to hospital for treatment. It is our practice, owing to the prevalence of malarial fevers in this district, to give a purgative followed by 10 grains of quinine morning and evening to all cases of fever detained in hospital, unless, of course, it is obvious that the fever is due to other causes besides malarial fever. This practice is not very scientific, but its results are excellent among Sudanese troops, as a single dose of quinine is very often all the treatment that is required

in a very large percentage of cases. In this particular case, however, as the man's evening temperature had registered 103° F., although next morning his temperature was normal, he was admitted to hospital for further treatment.

On the evening of July 21st, the day he was admitted to hospital, his temperature rose to 101° F., in spite of two further doses of 10 grains of quinine, but on the morning of July 22nd his temperature was again normal, and to all appearance the man seemed to be quite recovered, and he asked to be put on full diet, which request was refused. At 8.30 a.m. he told one of the orderlies on duty that he felt very ill, and complained of severe headache. In about fifteen minutes afterwards he became comatose. I saw him at 9 a.m., and he was quite unconscious, with stertorous breathing, and could not be roused; his pupils were dilated and reacted very slowly to light; his pulse was 120, and his temperature in the axilla was shown to be 100·8° F. Blood films were taken and stained with Leishman's stain, and on microscopic examination the parasites of malignant tertian were found in abundance, double infection of several of the corpuscles being particularly noticeable. Quin. hydrochlor., gr. x., was at once injected into the gluteal muscles of the left buttock, and orders were given for his temperature to be taken every hour, and the usual arrangements were made for the well-being of an unconscious patient. At 1 p.m. his temperature had reached 103° F., but soon after began to fall, the decline being accompanied by very profuse sweating. At 6 p.m. his temperature was 101° F., his pulse 108, and his general condition was much improved. He could be roused with a little difficulty, and seemed to recognise his name, but did not speak. He was, however, able to drink milk and brandy. Another intramuscular injection of quinine was given him at 8 p.m., and a special orderly put on duty. At 6 a.m. the next morning (July 23rd) his temperature was 97° F., and he was quite conscious, but his pulse was rather feeble, and his extremities were cold; he was, in fact, in a mild condition of collapse. The report of the non-commissioned officer in charge of the night duty party was that the patient had slept naturally all night. Hot bottles were packed round him, and hot milk and brandy given him to drink; this he took with every sign of appetite, and in about an hour he was quite lively and receiving the congratulations of his friends on his recovery. His case presented no further symptoms of interest, and he was discharged from hospital in a few days.

Cases of this gravity are, perhaps, very seldom met with among the negro races from uncomplicated malaria, at least, in the course of some years spent in tropical Africa, such a case has never before come under my observation. At a station like Wau it is, of course, impossible, under the present conditions, to examine the blood of all cases of malaria, but, from the large number I have had time to examine, it is my opinion that the benign tertian parasite is not commonly found in the blood of negro

soldiers, the usual parasite found when they are attacked with malarial fever being that of malignant tertian. Among the Egyptians, who are so often miscalled Arabs by the tourists in Cairo, both parasites are found, mixed infections being quite common, but the number of cases showing the benign tertian parasite alone preponderate. Another point of interest with regard to Sudanese troops is that, when they are moved to a malarious district after having been stationed for many months in a healthy station such as Khartoum, where malarial fever is now almost extinct, owing to the extermination of mosquitoes, they frequently suffer from attacks of fever, which are in some cases very severe, but after a few weeks they appear to become partially immune, and the admissions to hospital for malarial fevers diminish in consequence. This is of practical importance from a military point of view when it is intended to bring Sudanese troops for use in expeditions into malarious districts when they have been previously stationed in non-malarious ones; such troops should, if possible, be sent up at least two months before it is intended to begin operations, so that they may have time to become acclimatised.

NIGHT URINALS: A SUGGESTION.

By Captain ROBERT J. BLACKHAM.
Royal Army Medical Corps.

The question of night urinals for soldiers is a sanitary matter of interest to every officer of our Corps, and as I believe I am right in saying that the methods now in use in India find little favour with most of us, I think no apologies are necessary for submitting the following remarks on this important subject.

Captain W. S. Harrison, Assistant Professor of Pathology in the Royal Army Medical College, writing on the subject of "Our Present Position with Regard to Enteric Fever in India," says: "The question of night urinals is a more difficult one [than that of day urinals]. If one leaves the men with only the present day urinals they will not use them and the ground will continue to be soiled; if one provides occasional urine tubs or other receptacles for night use the same result will follow, *plus* a slop round the tubs. Urinals off the barrack-rooms would be objectionable on account of smell, and moreover, unless sufficient were provided, say four to a company, the soiling of the ground would continue little abated. The simplest plan of all would be to provide each man with a chamber pot for night use; it is the best arrangement for preventing droppings on the floor, for the men would hold them close up when using them. If they had a quantity of disinfectant put in them the urine would be rendered harmless as soon as passed, they could be emptied and cleansed each morning and a fresh supply of disinfectant could be put into them. The presence of non-commissioned officers in

the room and the general feeling among the men would ensure their proper use, and the fact that they are used in hospital and cause no trouble there, shows that they are practicable. The chief objection to them arises from the presence of drunken men; but if a man is too drunk to use a chamber pot he is too drunk to be in a barrack-room; the guard-room is a more appropriate resting place for him" (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. iii., p. 50).

This expression of opinion may be considered the last word on the subject of night urinals in India, and has hitherto passed unchallenged in these columns, but I venture to join issue with the learned writer on several points. I agree that it is unnecessary to provide urinals off the barrack-rooms, as this would involve great expense, not only in erection but in annual up-keep, yet I do not think Captain Harrison's alternative of providing each soldier with a chamber pot will find favour with either medical officers, commanding officers, or soldiers themselves. It would cost a great amount of money to provide these pots in the first instance, their maintenance in good order would be expensive, and the outlay involved by the use of a *sufficient* amount of non-poisonous disinfectant would be simply enormous. Moreover, the cleansing of the pots would require an army of *mehtars* for its efficient performance, and an expenditure of thousands of rupees on *jharons* alone. As Captain Harrison is aware, the routine issue of chamber pots to soldiers in hospitals has been discontinued; and, apart from this, I think it is scarcely correct to draw a parallel between the barrack-room and the hospital ward, as patients in hospital are invariably strictly sober, whereas, although *drunken* soldiers certainly do find their way to the guard-room, it is a well-established fact that a number of men thoroughly "fuddled," but not legally drunk, succeed in passing the sentry and "answering to their names" night after night in every barracks in the Empire. These gentry are the individuals who would play sad havoc with Captain Harrison's neat little row of chamber pots.

I think we should be chary of advocating any system of conservancy which relies entirely on chemical disinfectants, as in unskilled hands so many sanitary sins are committed in the name of disinfection, and the cost involved is always considerable if a reliable and at the same time non-poisonous disinfection is used.

Even the large sum of £18,000 per annum, which Captain Harrison proposes to save the State, would go a comparatively short way in the purchase of popular higher phenols and the provision and up-keep of chamber pots for 100,000 men.

In the plains of India, I think that a sufficient number of ordinary receptacles placed on a stand in the verandah, *at the proper level, in a good light,* and surrounded by a tray of sawdust or lime, to catch droppings, constitutes as good a means of receiving liquid night ordure as any other, and if disinfection of the urine is desired, the best and simplest

disinfectant is heat. The heat could readily be applied in a modified *pipa*, such as the apparatus devised by Major (now Lieutenant-Colonel) Glenn Allen (Journal of the Royal Army Medical Corps, vol. v., p. 606). This mode of treating urine costs very little, as 50 gallons, or the approximate nightly output of urine for half a battalion, could be "practically sterilised"—which is a vastly different thing to being mixed with a disinfectant—for the small outlay of about 4 to 6 annas, according to the price of wood.

I think that the "slop" to which Captain Harrison rightly refers, is not due so much to the present form of receptacle as to the bad light in which it is placed. Even in English barracks and hospitals it is difficult to get the urinals properly lighted, and in Indian barracks there is often no attempt to light the vicinity of the night urinals, with the inevitable result that in the morning they are found surrounded by pools of urine.

In the hills of India this method does not, however, recommend itself, as it does not obviate the necessity for getting rid of a large quantity of *liquid* sewage. Even in the plains, where there is abundant land for its eventual disposal, liquid sewage is difficult to deal with; but in the hills its disposal is a very serious sanitary problem, as sufficient land is, as I have pointed out elsewhere (Journal of the Royal Army Medical Corps, vol. vi., p. 663), rarely available for its reception; and, apart from this, the question of transport of liquid excreta arises in an acute form.

In the plains the filth cart, or "ironclad," offers an admittedly faulty solution of the problem, but these carts cannot be used in the hills, as wheeled traffic is impossible along mountain paths; and in consequence the urine of the night urinals, together with all waste material, has to be carried by hand to the cantonment garden, or mixed with refuse and destroyed in the cantonment incinerator. This manual method of removing the excreta of the subjects of typhoid bacilluria must be a fruitful source of the outbreaks of enteric fever so painfully familiar to those of us who have served in the Simla and Murree Hills.

Obviously the ideal method of disposal of urine in the hills would be to receive it in some absorbent and deodorant material, which could be carried away on the heads of the sweepers and burnt without further manipulation in an incinerator.

On looking round for such a method, the experiments carried out by the late Dr. Vivian Poore with sawdust at once suggest themselves to our mind. Although familiar to most of us, Lieutenant-Colonel A. M. Davies, Professor of Hygiene in the Royal Army Medical College, informs me that this method has never been *seriously* tried on a large scale in India, notwithstanding the fact that it seems well adapted, if not for the tropical heat of the plains, at least for the temperate climate experienced in all hill stations. I would remind my readers that Dr. Poore placed in his rooms at University College Hospital, a vessel containing 6 lbs. weight

of sawdust, and during about three months added to it 626 ounces, *i.e.*, 39 lbs., of urine, with the result that 3½ lbs. of filtrate appeared. The sawdust therefore absorbed, or caused to disappear by evaporation, six times its own weight of urine; and Dr. Poore asserts that his "experiments with sawdust, extending from December to July, and carried on in all kinds of weather, and indoors as well as out of doors, have *in no instance* given rise to offensive smell. If the surface of the filter, which has been some time in use, be stirred, and the nose almost buried in it, a strong smell of ammonia is perceived, but it is the smell of pure ammonia without foulness. The filter which I kept in my room at the College for some time never made me aware of its presence by any odour" ("Rural Hygiene," third edition, pp. 180-181). I think that the reason why sawdust has not been long since *seriously* tried in India is, as pointed out by Lieutenant-Colonel H. A. Haines (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. vi., p. 671), because it is not readily obtainable, and, in the Simla Hills at any rate, it would be well-nigh as expensive as a chemical disinfectant; but as I have shown in another article, we have everywhere on the Himalayan slopes an excellent absorbent vegetable material which will, I feel assured, be found almost, if not quite, equal to sawdust in most respects; I mean pine needles (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. vi., p. 662). These needles can be obtained in the vicinity of every hill station for the labour of collecting them; and I suggest that troughs containing the needles in the form of a rough powder should be placed on the verandahs of barrack-rooms and used as night urinals. These troughs should be placed at a convenient height, *and well lighted by reliable lamps*, as much of the fouling of the verandah under the existing system is, as I have shown, due to the fact that the urine receptacles are placed *on the floor and in the dark.*

This method is, I submit, worthy of trial, as it has the following advantages:—

(1) It is inexpensive; (2) it requires no elaborate apparatus; (3) the resulting mixture of urine and pine needles can readily be burnt; (4) the management of the troughs is quite within the comprehension of the native mind; and (5) the absorbent material is harmless and deodorant.

A CASE OF DISLOCATION OF THE SPINE; LAMINECTOMY; RECOVERY.

By CAPTAIN L. W. HARRISON.
Royal Army Medical Corps.

PRIVATE M., 1st The Queen's (R. W. S.) Regiment, was admitted to hospital on November 25th, 1905, with the following history: About half an hour previously to admission he was engaged in building a bomb-proof shelter, and while crouching underneath undercutting the earth,

the whole of the overlying earth gave way, falling on his back and burying him. He was extracted after about ninety seconds. On admission he was found to be bruised about the back and face, with subconjunctival hæmorrhage of both eyes. There was considerable swelling about the lower dorsal region, and on running the finger over the spinous processes, a marked depression was felt between those of the last dorsal and first lumbar vertebræ. No undue mobility or crepitus was noted. He complained of great pain all down his back, with tingling in the legs. Sensation to touch, heat and cold and pain were present, though dulled. Superficial reflexes and tendon phenomena in both lower limbs were absent, and there was complete paraplegia. Later the urine had to be drawn off by catheter, and an enema to open his bowels was returned unchanged. During the night, in spite of two hypodermic injections of morphia, $\frac{1}{3}$ grain, he continually shouted with the pain in his back and legs.

A diagnosis of partial dislocation of the spine, with hæmorrhage outside the cord, was made.

He was placed on a hard bed with all arrangements to prevent bedsores, and besides sedatives as required, he was put on 10 grains of urotropine thrice daily in view of probable bladder complications.

Colonel Whitehead, R.A.M.C., saw him with me next day, and advised waiting before operating.

On November 27th his condition was noted to be unchanged, except that some sensation had returned to the bladder, so that he asked for his urine to be drawn off. His bowels were opened, the motion being passed into the bed without warning or consciousness. There was rather less pain. The urine had become slightly ammoniacal, so the bladder was washed out.

On November 30th he was found to have much less pain, and he was able to pass his urine. Complete paralysis, with loss of reflexes, and loss of control over the rectum, still remained unchanged, and Colonel Whitehead, who saw him with me, agreed that operation with a view to removal of any blood clot pressing on the cord was advisable.

The troops had left the station on manœuvres, carrying almost all the surgical instruments, so I had to collect instruments from various sources for the proposed operation, which, with the sterilisation of the silk for sutures, caused a delay of two days. Meantime the patient's condition remained unchanged.

Operation.—On December 2nd, assisted by Captain F. C. Rogers, I.M.S., by a]-shaped excision extending from the eighth dorsal to the third lumbar spine, I exposed the spinous processes and laminæ of the eleventh and twelfth dorsal and first and second lumbar vertebræ, and found the supraspinous ligament between the last dorsal and first lumbar vertebræ and the ligament connecting the left lower articular process of the last dorsal and corresponding upper process of the first lumbar

vetebræ torn. The spines of the eleventh and twelfth dorsal and first lumbar vertebræ having been removed, I attempted to snip the laminæ at their bases with a pair of straight bone forceps, but these being ill adapted by their shape and also blunt, this failed; a similar attempt to cut the laminæ with a locally made Hey's saw also failed, so with a half-inch trephine I removed discs of bone from the laminæ of the last dorsal and first lumbar vertebræ at the bases of the spinous processes. The ligamenta subflava in this situation was torn and a clot the size of a haricot bean was lying on its posterior surface, while on its anterior surface was some organised blood clot. Snipping the same laminæ outwards with forceps, the dura mater was exposed. It appeared healthy and shining, and did not bulge, so it was decided not to introduce complications by opening it, particularly as the conditions already found were sufficient to account for the patient's symptoms. Hæmorrhage, which was pretty profuse without, was controlled by packing long pads of lint soaked in very hot water against the muscles, and by a previous injection of hemisine into the muscles on both sides of the first incision. The wound was closed by deep silk sutures holding the muscles, and similar sutures through the skin, a plaster jacket was applied, and he was put to bed on his face. He slept pretty well, but complained of the position.

On December 3rd he had to be changed to the side, as he positively refused to lie prone any longer. Two days after the operation he contracted his left rectus femoris slightly. The urine had to be drawn off till December 5th, when he passed it voluntarily. Except that the leg muscles seemed firmer day by day, no further increase of power occurred till December 11th, nine days after the operation, when he very distinctly contracted his right rectus femoris. The skin sutures were removed on the 13th, when the wound was found to be perfectly healed except at the top half inch, where a narrow line of granulations showed.

On December 14th he contracted his right hamstring muscles, and his power continued to improve, till on January 20th he commenced trying to walk, being able to move his legs, though not able to support his weight. On January 28th he walked across the ward unaided, and on March 3rd, when the plaster jacket was removed, he ran the length of the ward for my benefit. The only rise of temperature during the healing of the wound was fifteen days after the operation, when it rose to 99° F.

Patient, when last heard of, August 6th, was doing duty in the second battalion of his regiment, but it is likely that his back is not strong enough to allow of his performing all the duties of a soldier.

CASE OF HÆMORRHAGE INTO UMBILICAL CORD, CAUSING HYDRAMNIOS AND DEATH OF FŒTUS.

By Captain D. G. CARMICHAEL.
Royal Army Medical Corps.

Mrs. S., primipara, aged 21, whose pregnancy had progressed favourably until the eighth month, began to show signs and symptoms of hydramnios; abdomen became very prominent, tense and globular in shape; a distinct percussion thrill could be felt, the fœtal parts were ill-defined, and the fœtal heart sounds, which had been heard quite distinctly from four and a half months onwards, now became inaudible. Urine was scanty, but not albuminous. Under appropriate treatment, rest and diuretics, the abdominal circumference was reduced on an average about ¼ inch daily. At eight and a half months the patient was delivered of a dead male fœtus, weighing about 7 lbs., and it was then seen what had been the cause of the hydramnios and death of fœtus. About 12 inches from the umbilicus there was a swelling on the cord about the size and shape of a small hen's egg. When this was cut open it was found to be a solid clot of blood, which had escaped from and was partially distending the umbilical vein, and exerting pressure on the umbilical arteries, thereby entirely cutting off the circulation. The cause of the hæmorrhage was not very evident; the cord seemed to be quite normal in strength and appearance, except that it was somewhat thicker than usual. The epidermis had peeled off parts of the fœtus, and the head bones were very loose, the fœtus apparently having been dead for several days. The mother passed through an uneventful puerperium, the fundus uteri reaching brim of pelvis on thirteenth day, and made a good recovery.

BILHARZIA DISEASE IN MIDDELBURG, TRANSVAAL.

By Captain J. E. H. GATT.
Royal Army Medical Corps.

There were no less than nine admissions for this disease among the garrison of Middelburg, Transvaal, between July 21st, 1906, nd September 16th of the same year. All the cases were contributed by the 3rd Middlesex Regiment. This unit arrived at the station on January 12th, 1904. They had bathing parades at the Klein Oliphants River, just outside the town, once a week, about 6 a.m., between October and February.

According to a local practitioner, the disease, otherwise known as endemic hæmaturia, is very prevalent among the civilian population, especially among boys from 7 to 16 years of age, both European and native; it is generally attributed to bathing in the Klein Oliphants River, and has been greatly on the increase.

The previous admissions from this garrison for the years 1903-5 were as follows:—

1903 (March 17th).—One admission from the 2nd Dragoon Guards. This unit arrived at the station on June 28th, 1902. The man's whole service in South Africa at that time was one year and one month.

1904.—No admissions.

1905.—Three admissions. May 23rd, one man from the 2nd Leinster Regiment; June 13th, one man from the 2nd Leinster Regiment; October 15th, one man from the 3rd Middlesex Regiment.

1906.—Nine admissions. Case 1, service in South Africa prior to admission three years ten months; service in Middelburg eleven months; admitted July 21st, 1906. Case 2, service in South Africa prior to admission ten months; service in Middelburg ten months; admitted July 23rd, 1906. Case 3, service in South Africa prior to admission two years three months; service in Middelburg two years five months; admitted July 24th, 1906. Case 4, service in South Africa prior to admission eleven months; service in Middelburg six months; admitted August 22nd, 1906. Case 5, service in South Africa prior to admission eleven months; service in Middelburg eleven months; admitted August 25th, 1906. Case 6, service in South Africa prior to admission one year five months; service in Middelburg one year five months; admitted August 30th, 1906. Case 7, service in South Africa prior to admission two years two months; service in Middelburg two years two months; admitted September 4th, 1906. Case 8, service in South Africa prior to admission two years six months; service in Middelburg two years six months; admitted September 14th, 1906. Case 9, service in South Africa prior to admission two years two months; service in Middelburg two years two months; admitted September 16th, 1906.

Cases 1, 4, 5 and 8 stated that they first noticed blood in the urine about a month before admission. Cases 1 and 4 had been in Barberton for four months. Assuming that the infection occurred in the Klein Oliphants River at Middelburg, Transvaal, sometime between October and February, the incubation period appears to work out at six to ten months. It is reasonable to suppose that infection occurred from the same source, about the same time, and in the same way.

On examining the river water, collected from the immediate neighbourhood of the bathing place, on September 26th, 1906, I found any amount of water-fleas (*Daphnia pulex* and *Cyclops quadricornis*—both freshwater crustaceans). Specimens of the first could be seen carrying their eggs or their young, almost perfectly formed, under the carapace. Specimens of Cyclops were also seen carrying a pair of egg-sacs attached to the lower part of the body; but no ecto- or endo-parasites could ever be seen, even after artificially infecting the water with living ova of bilharzia recently evacuated.

It was ascertained that these ova were living, by examining a drop-

of urinary sediment soon after being evacuated by patients and freely diluted with water. The following phenomena were then observed: The inside of the egg, which is granular and semi-transparent, begins to show movements of contortion almost immediately; this movement, which is at first jerky and intermittent, is gradually communicated to the whole embryo, and finally becomes continuous. In some cases two polar cells can be seen (one at each pole), which are from time to time taken up in the body of the embryo, and again become separated, but generally remaining at the poles of the egg. At the end of fifteen minutes, on an average, the embryo suddenly breaks out of one of the sides of the ovum; it now contracts actively upon itself, somewhat in the shape of a dumb-bell, until it disengages itself completely from the shell, and, once free, it swims actively about and disappears from the field. I could never see embryos moving in their shell so long as the urine was undiluted; and if the urine was kept over-night and the sediment examined next morning, freely diluted with water, all the eggs were also found dead.

BARRACK-ROOM SORE THROAT.

By Major S. F. CLARK.
Royal Army Medical Corps.

Major McNaught's paper on the bacteriology of sore throat (Journal of the Royal Army Medical Corps, September, 1906) has "taken the wind out of my sails," as I was preparing an article on the same subject.

In the Orange River Colony "septic" sore throats are very rife among the troops during the winter, and I paid some attention to the matter. As the men are housed in huts, which are comparatively new, it would seem that the local conditions of barrack-rooms, which Lieutenant-Colonel Caldwell refers to in his "Military Hygiene," are not at fault; but it is rather remarkable that these sore throats are common during the dry, dusty winter, and show a tendency to disappear as soon as the rains begin. When the epidemic of sore throats at Bloemfontein was at its height, several cases of facial erysipelas occurred among the troops, and I learned that it existed in the town also. There is no military destructor here, and refuse is dumped in various places, more or less round the cantonments. I examined some of this refuse and found innumerable staphylococci in it—an organism which was also present in practically every case of sore throat. Of course, it is a very ubiquitous coccus, but putting all these facts together would lead one to think that the bad throats and the erysipelas were probably due to infection by dust. Anybody who has been in South Africa will admit that it is impossible to avoid a close acquaintance with dust, and that the face and fauces are bound to share in this unpleasant intimacy. It is significant that the laying of the dust

by the rain is followed by a diminution of the number of cases of sore throat. Nearly all the cases examined had congested fauces, while the tonsils were red, swollen, and exuding a dirty yellowish-white discharge. Several had a membrane, but in no case was *Bacillus diphtheriæ* found, and the subsequent clinical features of these cases showed that the negative bacteriological diagnosis was correct as regards diphtheria. Hoffmann's bacillus was occasionally present, but the organisms which were never absent were staphylococci.

I was much interested to see that Major McNaught had found a yeast in one case, as I also isolated one from a throat that was suspected to be diphtheritic. There does not seem to be much literature on the subject of pathogenic yeasts, but they do exist, and probably some bad cases of sore throat are due to them, as at Lincoln. They appear to float about in the air; though my laboratory attendant suggested that they might get entangled in the throat during the imbibition of beer!

The yeast I found had cells of various shapes, but most of them were ovoid and about the size of a red blood corpuscle. Each showed an envelope containing granular protoplasm, in which vacuoles were very evident, and many of these vacuoles had in them a rapidly moving dot. In a hanging drop preparation the cells showed undoubted slight motility, and budding was very clearly seen. On beer-wort an abundant, thick, whitish, creamy growth occurred in twenty-four hours at 22° C., while on agar the growth was of similar appearance, but was scanty and formed very slowly. From a broth culture acid was obtained, while the organism stained well with Gram and the ordinary colouring agents. Its pathogenicity on animals was not tried.

I think the theory of dust infection is, in this country, more probably right than the suggestion that the fauces and tonsils are devitalised by the cold weather, and that the "sore throats" thus caused become septic owing to their being attacked by the organisms which are apt to flourish in the too frequently neglected mouth and teeth of the soldier.

Travel.

WITH THE BRITISH MEDICAL ASSOCIATION TO TORONTO — AND AFTER.

By Colonel J. M. BEAMISH.
Royal Army Medical Corps (R.).

August 10th, 1906.—Our start is made in a well-appointed special train leaving Euston at 12.40 p.m. in connection with the Canadian-Pacific s.s. "Empress of Britain" (20,000 tons), timed to leave Liverpool the same evening. In cool, pleasant weather the journey to Liverpool is completed by 5.30 p.m. and, after some delay in the arrival of baggage from the railway siding to the wharf at Prince's landing, and in moving off of the White Star s.s. "Cedric" for New York, the offing is cleared for the "Empress," which, with the aid of a tug, takes up a convenient position for embarkation of the passengers bound for Quebec and Montreal.

A final start is made about 7 p.m., dinner is served, and nothing eventful takes place during the Channel passage till daylight on the 11th reveals our position off Moville on the western shore of Lough Foyle, where we are condemned to await arrival of the mails till 1 p.m., in view, however, meanwhile, of a fine range of mountains, which, if not striking from the point of elevation, form a pleasing setting to the shapely lough. Some banks of clouds resting on the highest points, and broken at intervals by streaks of sunlight, make up a sufficiently characteristic picture of Erin with the "tear and the smile." We number about 250 first-class passengers, among them upwards of forty attending the meeting at Toronto. During the afternoon we observe some bolder coast scenery terminating in Malin Head, where a Marconi station is established. The sea is calm, the weather fine, and in a few hours we lose sight of the Donegal coast to face the broad Atlantic. The cuisine is excellent; the weather, too, is brighter than it was nearer the coast.

August 12th (Sunday).—The morning is fresh, with a surface swell on the sea, giving it an oily appearance. Later in the day the sea is slightly rough, imparting some motion to the ship, but scarcely enough to disturb the composure of the least nautically inclined. A fairly large congregation assembles for the Church

of England service, conducted by a clergyman who is a passenger. The second-class and steerage passengers are more in evidence than hitherto—a goodly number of the latter, almost entirely British, bound for the Dominion. The temperature in one of the first-class cabins on the upper promenade deck registered about 65° F. on two successive afternoons between 3 and 4 p.m.

August 13th.—There is a perceptible change to colder weather (58° F. at 11 a.m.), with choppy sea, a stiff breeze (north), and clouded sky; also a tendency on the part of passengers to seek sheltered corners, and avail themselves more than hitherto of such refuges as the lounge or café, music-room (as yet without the music), and library. And here it may be convenient to describe the situations of the principal reception rooms in one of the most modern of Atlantic floating hotels. The central feature is the dining saloon, amidships, on the main deck. This is overlooked from a balustrade by the café or lounge, the most comfortable apartment in the ship, well furnished with easy chairs and sofas, where it is permissible to smoke in general company, and tea is served in the afternoon. Immediately above this, separated by a canopy, in the centre of which is the base of a ventilating shaft, is the music-room, a palatial apartment decorated in the best style, on the same level as the cabins on the upper promenade deck, and the corresponding promenade round the ship. The library, with comfortable chairs and writing tables, overlooking the steerage forward, is connected with the café by two passages, while a smoking room similarly connected by a single passage overlooks the second-class deck sternwards on the same level. The state-rooms are numerous along the passages, but, while the ventilation is good on the whole, the conveniences, and especially cabin space, show little or no improvement on older vessels. The sanitary arrangements are good, and well up to the modern standard. The "Empress of Ireland," eastward bound, was signalled at short distance about 8.45 p.m.

August 14th.—Day broke with a fog, clearing, with glimpses of sun, towards mid-day; less cold than yesterday—60° F. 8 to 10 p.m., musical soirée.

August 15th.—Slowed down during the night, owing to fog and apprehension of icebergs. The latter were judged to be near from the appearance of some pieces of floating ice. A sailor dryly remarked anent this fact, that "when chickens are about, the hen is not far away." Fishing smack visible. In Marconi communication with Cape Race. Dull and overcast with fog up to

11 a.m.; temperature 60° F. Skirting the coast of Newfoundland, and in sight of Cape Race at 4 p.m. More fishing smacks in sight. The coast appears as a low headland with broken cliffs devoid of trees. Concert, 9.30 p.m., in aid of Seamen's Charity, Liverpool.

August 16th.—Early fog as usual, lifting about mid-day, stiff breeze, temperature 60° F. Letters for Rimouski posted 10 p.m. Up to this date the average run for five complete days was 433 miles per day.

August 17th.—Off Rimouski, on the south bank of the St. Lawrence, at daylight; mails landed and despatched; morning fine and warmer; mouth of the Saguenay, 100 miles below Quebec, visible about 10 a.m. Here the river has a width of 16 miles, graduating to a maximum of 60 miles, 300 miles seaward from this point to Cape Gaspè, at the mouth of the gulf. Higher up, as the river narrows, a beautiful vista opens to view, showing a wooded landscape on both sides with neater and more prosperous settlements on its banks than lower down, and churches everywhere; numerous islands, some three miles or more long, southwards, and, even when rocky and barren, as many are, affording a nidus for the growth of the ubiquitous pine. A noble range of mountains (Laurentian), showing a more or less regular contour and blue colour, stretches away to the far horizon on the north. Pine woods are numerous in the foreground, with cultivation between, at intervals on either bank; the whole waterway amid its superb surroundings furnishing the portal to a magnificent Empire. The river narrows to four miles as Quebec is approached, and its spires and battlements, as well as the building at Levis, also occupying high ground on the opposite, or south bank, form striking landmarks. The entrance to the St. Charles River is now seen, with the lower town of Quebec situated on its banks, the Island of Orleans opposite, eastward, and Montmorency falls on the north-east. A good view of the Plains of Abraham, and a portion of the route traversed by Wolfe's besieging army in 1759, is obtained from the western rampart of the citadel, and a general idea of the upper town is obtained by a circular tramcar ride round the principal streets, including a view of Wolfe's Monument, Hill of St. Jean, the English Cemetery and Basilica (Roman Catholic Cathedral), up to the Hotel Frontenac, one of the best in the country, on the site of an old chateau, in the style of the original building, of which some traces are preserved. The population of Quebec (total 81,000) is for the most part French-speaking,

and the whole place still retains many traces of its French origin. During a band performance on Dufferin Terrace, fronting the hotel, between 8 and 10 p.m., a very pleasing view is obtained of the river and the town of Levis, opposite Quebec, the lights on the sloping terraces of the south bank recalling Genoa, and those in the ferry boats plying to and fro on the river beneath suggesting the Grand Canal of Venice.

August 18th.—Quebec to Montreal and Ottawa.—Left Quebec at 2 p.m. The route by rail lies at first through some woodland scenery broken by cultivated farms with neat residences. Pines, of small size as a rule, interspersed with birch, alder and willow, are most numerous. The comparatively stunted growth of the forest trees, and also the absence of roads, are noticeable both here and below Quebec. Over the greater part of the route the soil is not rich, if one may judge from the quality of the crops (largely buckwheat, oats and Indian corn) and the condition of the cattle, which did not appear to be well nourished. It is sandy in character, as a whole, sand-dunes appearing occasionally. The farms are divided into narrow plots, mostly of small extent, the homesteads also being unpretentious—Swiss cottage in design. Arrived about 7.30 p.m. at Viger Street Station, Montreal. A fellow member of the British Medical Association drove with me across the city to Windsor Street Terminus, where we dined, proceeding at 9.40 by a night train to Ottawa, due there at 12.40 a.m., but actually arriving half an hour later.

Windsor Street Station at Montreal has a fine vestibule with massive ornamental pillars, a contrast to the railway station at Quebec. No doubt, with this example, and as funds accumulate, better stations will be elsewhere provided. The cars are on the American pattern, commodious, and, where necessary, provided with dining, sleeping and extra (parlour) accommodation.

August 19th (Sunday).—Ottawa.—We found ourselves just in time, the morning after arrival, for an inspection by the Governor-General, on church parade, of the 5th Massachusetts Regiment from Boston, at the exhibition grounds south of the city. They had arrived the previous night, or early morning, on a return visit to the 43rd Canadian Infantry, and hospitalities were freely dispensed in various forms, by a dinner at Government House to the senior officers of the regiment, as well as excursions during the day to the riverside pleasaunces of Aylmer, on Deschenes Lake, and Britannia, on the east and west sides respectively of Ottawa River, and distant eight or ten miles from the city. Bands were

in attendance at these places, and favours exhibiting the stars and stripes were displayed everywhere. The Bostonians, officers and men, were smartly dressed in blue frocks with trousers of a lighter colour. The former lodged in hotels, for the most part, the latter, camp fashion, in the exhibition building. They were spare in figure, as a rule, and well set up, with a high average of intelligence among the rank and file, so far as could be observed. The officers also showed a most soldierly bearing. A detached soldier of the local corps might be seen detailing his South African experiences to his American cousin, and the best of good feeling was evident between the entertained and their hosts. Ottawa has many handsome buildings besides the Parliament House and City Hall, and the suburban residential quarter is worth a visit. The day temperature was high, 93° to 94° F. on the 18th and 19th, and as high as 88° F. late at night. The dryness of the air, however, made the heat somewhat less unpleasant in its effects.

August 20th.—Ottawa to Toronto.—The general features of the country are unchanged, isolated plantations, mostly of pine, diversifying a rather tame landscape. An impounded river, forming a lake, formed at one place a pleasing variety to the prevailing monotony. The soil, a light loam, is apparently superior to that lower down country, as evidenced by the crops (oats, &c.) and cattle. Hedges, too, begin to appear and roads are more numerous than hitherto. An absence of birds, except at Ottawa itself, was observed on this route. The scarcity of singing birds may, however, make this dearth of the feathered tribe more apparent than real. As Toronto is approached the pines give place, in a great measure, to foliaceous trees, and besides cattle, pigs, geese and poultry are seen at this stage. Hills at some distance, well wooded, also appear, and along the railway are well-cultivated fields with rich crops and orchards, recalling, for a pleasing variety of landscape, portions of Kent and Surrey. Lake Ontario is closely approached, and its margin followed, for a distance of 70 miles from Toronto, and the district on its borders, portioned out into larger holdings, well fenced and wooded, with rich crops, roads and comfortable farmhouses, presenting all the appearance of a settled country.

August 21st to 25th.—Toronto Meeting.—The opening address was delivered in the University Hall of Convocation, during a hot afternoon, on Tuesday, August 21st, in the course of which audible and fluent addresses were delivered by the retiring President of the British Medical Association and the Mayor of Toronto. The address in surgery, on the "Technique of Operations on the

Central Nervous System," was delivered the next (Wednesday) evening, to a large and appreciative audience, by Sir Victor Horsley, in a style which, for facile delivery, lucidity and exhaustive treatment of the subject, could not be surpassed. A garden party at Government House on Tuesday afternoon was followed by similar entertainments and receptions at the City Hall, University grounds and elsewhere. Sectional meetings, already reported at length in the *British Medical Journal*, were held in the University building on the several days, and the meeting, which, as a whole, from all points of view, was a great success, practically broke up on Saturday, the 25th, to enable visitors to enjoy further the hospitality so freely offered to them in the form of excursions to Niagara, Muskoka Lakes, as well as more extended trips to the Great Lakes, the Rockies, Vancouver, &c. To omit detailed description of its many attractions, handsome streets, University, City Hall, churches, hospitals, and other public buildings, together with its unrivalled situation on Lake Ontario, of Toronto, it may be said that, while possessing marked British characteristics, it shares with other leading Canadian cities that spirit of enterprise and commercial activity which has made it famous as a distributing centre from its earliest days—a feature which it still retains to a much greater extent, with its vastly improved facilities of communication.

August 25th to 27th.—Muskoka Lakes.—These—styled the "Killarney of Canada"—are reached by rail in three or four hours north from Toronto. A large party of the British Medical Association was entertained, soon after arrival at Muskoka wharf on the 25th, to lunch at the Consumptive Sanatorium, Gravenhurst, near the south end of the Lakes, *en route* for stations higher up, among which the visitors were distributed, by means of two steamers chartered for the purpose, to the various hotels and boarding houses as far north as Muskoka Hotel, and even beyond. The whole route, which is merely a large bay studded with numerous wooded islands of varying size, and intersected at certain points by locks for passage of steamers, is not without a quiet beauty of its own, but after a certain distance loses interest to some extent through the unvarying character of the scenery. Several of the islands are owned by Americans flying their flag, who have built châlets with boathouses for occupation during the summer months.

The Sanatorium at Gravenhurst consists of a main double-storied block of buildings of wood, on a high site, near pine woods, overlooking Muskoka Lake, and accessory wards in similar, but

smaller, detached buildings at some distance, about a mile, from the main block. There is a residential staff, including nursing establishment, and the arrangements are most complete in every respect. Open verandahs, spacious dining halls, well-lit and ventilated wards, were some of the principal features of the establishment. It is, I understand, State supported, but aided by public subscription, and appears to answer its purpose extremely well. The above was a week-end trip, most of the party remaining in the Muskoka district over Sunday, and returning to Toronto by the same route on Monday the 27th.

August 23rd to 25th.—Niagara was arranged for on two days, Thursday, 23rd, and Saturday, 25th, both including a visit to the Power House, and lunch at a restaurant in sight of the Falls. Lake Ontario was first crossed to Lewiston by steamer, and the Gorge then followed by rail on the American side, at close distance, the whole way to Niagara, a good view of the whirlpool being obtained *en route*. I can only say of Niagara that it came up to expectation, but whether it was made familiar during a previous existence, or largely discounted by photography, it is useless to speculate. The return journey, the same evening, was slightly varied by a rail trip on the Canadian side of the Gorge for a certain distance, when a bridge was crossed, and the steamer rejoined at Lewiston.

August 28th.—Lake route, Toronto to Fort William.—This occupies two complete days, Sault St. Marie, on the rapids of St. Mary's River, connecting the waters of Lakes Superior and Huron, being exactly half-way. A start was made about 2 p.m., August 28th, from Toronto by rail to Owen Sound, 122 miles north-west, occupying three to four hours, where we embarked on the steamer. Land remained in sight while daylight lasted, and Georgian Bay was entered by moonlight. We entered Lake Huron the following morning in showery weather, after a somewhat rough night. Manitoulin Island, eastward, was passed in due course between 9 and 10 a.m., later also some lumber craft with great length amidships, sailing downstream, till the Canadian Lock was entered at Sault St. Marie, about 2 p.m., the 29th. There are considerable towns on both sides of the river—that on the American side (Michigan) being the larger—with manufacturing establishments, acetylene works, pulp mills, &c. There are two locks on the American side also, and the river at this point is spanned by the Soo Railway, connecting Sudbury on the main Canadian Pacific Railway line with St. Paul and Minneapolis. Above the locks a broad waterway is

entered with low-lying wooded banks, and its course followed for a couple of hours till Lake Superior is entered. Here cold increases perceptibly, and a straight course is steered north-west across the Lake, in showery weather and bright moonlight, to Thunder Point, round which the bay is entered, and Port Arthur gained about noon on the 30th. Hence, after a short stay, the voyage is completed within an hour to Fort William, at the head of Lake Superior.

August 30th.—Fort William, once a trading centre of the Hudson's Bay Company, is now an important grain emporium, growing rapidly in size, and provided with a large elevator, railway workshops, hotels, &c. We left Fort William at 10 p.m. by night train for Winnipeg.

August 30th.—*En route* to Winnipeg.—The night was chilly, and day broke with a hoar frost and some fog, which cleared as the day advanced. The visible route lay through a pine forest, and some rocky or stony country, with tarns or small lakes at intervals, resembling, according to one account, parts of Sweden. The Lake of the Woods was reached at 7 a.m.; westward the forest almost disappears. About 50 miles from Winnipeg small settlements begin to appear, increasing in size, with wheatfields and cattle in good condition, till the Red River and Winnipeg are reached. At Winnipeg a short stay was made for change of carriage and booking of sleeping accommodation in advance; but no time was left for even a cursory inspection of the city—a marvel of modern progress, with a present population of 100,000, and streets and public buildings rivalling those of the principal cities of the American continent.

August 31st.—For a distance of 50 miles west of Winnipeg, as far as Portage la Prairie, the wheatfields increase in extent and richness of crop—just reaped at time of visit—grown for the most part in a dark loam of considerable depth. resembling black cotton soil, till a country is entered some 100 miles in extent up to Brandon, and centring in a plateau midway, about Carberry, where the soil is most fertile—a rich humus—the wheat crop luxurious, cattle and draught horses sleek and well fed; and towns are met at intervals of a few miles, with a busy and prosperous appearance. Fifty miles further west, at the end of seven hours' journey, about 200 miles from Winnipeg, the best of the wheat-growing country of Manitoba is traversed in a single day, and a truly magnificient sight it is, at the harvest season, creating visions of food for all time for our own, in this respect, less favoured islands.

September 1st.—Regina, the capital of Saskatchewan, was passed during the night. Daylight, however, revealed the general character of the province as a serious of rolling downs in which wheat cultivation was largely replaced by ranches of cattle, in herds varying in number from 50 to 150 or upwards, also of horses and sheep. Towards the extreme west of the province the herdsmen had seldom any better shelter than tents or log huts, and the droves of cattle appeared to be entirely uncared for in this respect, being camped out in the open prairie—in excellent condition, however. Numerous lakes, often bituminous, are spread over this country, and at one point the Cypress Hills, visible from the railway, furnish streams which are valuable for irrigation purposes. The land is fertile in places, and the climate mild as compared with Eastern Canada, but the country urgently needs colonisation. About 10 a.m. the west-bound train was held up at Irvine, a few miles from Medicine Hat, owing to a collision between two freight trains, at a point midway, whereby both engines were telescoped and three men fatally injured. After a delay of some hours while the line was being cleared, the passengers had an opportunity of seeing the wrecked engines at the scene of the accident, and also Medicine Hat, of which, as an example of the rise and progress of the newer Canadian towns, I quote a borrowed description: "This town, with a population of 3,500, is situated on the east border of the Province of Alberta, on high ground overlooking the southern branch of the Saskatchewan River. It owes its origin to its natural advantages as the centre of a good ranching and mixed farming district; its situation on a river navigable for steamboats some distance above, and for 800 miles below to Lake Winnipeg; its proximity to coal-mines and natural gas, the latter furnishing cheap fuel, light, and power to the town; and, lastly, to the fact that the snowfall is light, and the winter shorter there than anywhere else in Canada east of the Rockies." The prairie dog—a species of marmot, which barks like a small dog—and coyoti are seen in this neighbourhood.

September 2nd.—Calgary, the junction for Edmonton, lying north, another rising district, was passed at night, and daylight found the west-bound train at Banff (4,500 feet), ten and a half hours late. The first view of the Rockies reveals a series of jagged peaks, flanked by pineclad spurs, overlooking a valley three-quarters of a mile wide, traversed by the Bow River flowing east. The valley is traced to Laggan, and in its course a number of fallen pines and cedars, the result of forest fires, come into view, dis-

figuring the landscape considerably. An ascent is made from Laggan to the Great Divide, a little west of Stephen, the backbone of the Rockies, whence some snowfields and glaciers are visible towards the south. Fallen trees are here more numerous. A descent is now made towards the Yoho Valley, skirting the Duomo (cathedral mountain) and Mount Stephen (10,500 feet) to Field (4,000 feet), which was reached at 9 a.m. A delay of some hours here, till 1 p.m., allowed time for breakfast at the hotel and a survey of the place, showing a fine panorama of pine slopes, converging valleys, and bare, weathered summits of crumbling rock, together with a very near view of Mount Stephen, towering in its giant proportions immediately above the station. At Field another accident was reported westward, which proved, later in the day, to be an overturned truck obstructing the line not far from Bear Creek, 80 miles ahead. The weather conditions here were perfect, temperature 60° F. Field was left at 1 p.m., and a descent made along the Kicking Horse River, round the spur of Mount Hunter, with the Ottertail (highest point, Mount Goodsir) and Beaverfoot Mountains southward on the left. At this point the cañon narrows, and beyond Palliser the gorge deepens, while the railway crosses and recrosses the surging and impetuous river, till it falls into the Columbia at Golden. The Selkirks westward on the opposite side of the river now display an extensive wooded vista, ranging from southeast to north-west, and parallel to the Rockies eastward. A little further on at Donald the railway crosses to the left bank of the Columbia, till, inclining further to the left, it enters the Beavermouth gorge at the convergence of the Selkirks and Rockies, and, quitting the Columbia, crosses to the left bank of the Beaver River, which it ascends to Selkirk summit, in full view of the Beaver Valley and River flowing northward to join the Columbia. At Beavermouth is a mighty conjunction of forces, railway, mountain and river, struggling for the mastery, and the contest is resumed further west, as the Columbia, returning from its northward bend, and refreshed by additional streams, rejoins the railway at Revelstoke, once more to pursue its stately course in an opposite direction, southward through the Arrow Lakes, and thence southwest through the State of Washington to the Pacific, a little north of Portland. During transit of the Selkirks and Rockies, passenger trains are provided in front with an observation car, admitting of an open view on three sides, whereby the several objects of interest *en route* can be thoroughly examined. Between Selkirk summit (4,350 feet), the summit of the pass, and Glacier House, are the

well-known snowsheds protecting the railway from avalanches and landslips, and near the latter the Illecillewaet glacier and Mount Sir Donald (10,000 feet). There is hence a steep descent by means of loops to the gorge of the Illecillewaet River, through which the train meanders to the sound of rushing waters beneath; thence through the Albert Cañon (2,217 feet) to Revelstoke, where it again meets the Columbia flowing south, while the railway in its west-bound course hugs the south banks of the Shushwap and Kamploops Lakes, in the course of the Thompson River, which ultimately joining the Fraser River at Lytton, the united stream flowing through the Fraser Cañon for a distance of 150 miles, and becoming tidal at Yale, 100 miles from the coast, reaches the Pacific by a number of creeks at and south of Vancouver. This journey across Canada was completed at 2 p.m., September 3rd, or six days from Toronto, a day having been lost through delays and accidents *en route.*

September 3rd.—Vancouver (population 20,000) has literally risen from its ashes since it was destroyed by fire soon after its foundation in 1886. It is now a thriving town, with handsome streets, wharves, warehouses, electric light, a park, and a first-class hotel. It is also in steam communication across the Pacific with all the ports of the Far East, China, Japan, Honolulu and Australia, as well as the coast towns of America. The country southward towards the Fraser River is adapted for general farming and fruit growing, but much remains to be done towards development in these directions and clearing the ground, even in the immediate vicinity of Vancouver. The salmon canneries at Steveston, near the mouth of the Fraser, are easily reached in little more than an hour by an electric railway; but were not in operation at the time of the writer's visit.

September 4th and 5th. — Victoria, the capital of British Columbia, on Vancouver Island, is readily approached from Vancouver by means of the "Empress Victoria," a fast local steamer, which makes the trip each way to and from Vancouver in about four hours. The Parliament buildings are, as usual, imposing; almost a replica of those at Ottawa in general plan, but smaller. There are handsome streets, showing but little business activity however, and residential suburbs, the latter the resort of rich immigrants seeking change from the less genial climate of continental America, and also of some retired (Indian) officers, some of whom are engaged in fruit-farming. The climate is mild, resembling that of the south of England. If snow falls it does not lie long. The annual rainfall is about 26 inches.

Victoria Daily Weather.—Tuesday, September 4th, 1906: Highest temperature, 67°; lowest, 52°; mean, 59.

Victoria Weather.—August, 1906: Highest temperature, 80·5; lowest, 45·4; mean, 62·25.

Total precipitation for month, 0·53 in.; average amount, 0·57 in. Bright sunshine, 285 hours and 42 minutes; mean daily proportion, 0·61 (constant sunshine being 1).

At Esquimault, a few miles from Victoria, are defensive works and a dry dock, but it is now abandoned as a naval station, much to the regret of the residents. Some well-marked glacial cross striæ were noticed here on the surface rock.

September 6th.—Vancouver once more reached, the return journey by rail was resumed as far as Revelstoke, 1,475 feet above sea-level, and 379 miles from Vancouver, by a night train. From this point a side trip was made southward by rail and steamer through the central mountains of British Columbia by the Arrow and Kootenay Lakes, and thence eastward by the Crow's Nest Pass route, to rejoin the Canadian Pacific Railway main line at Dunmore Junction in Alberta.

September 7th.—The scenery along this route is of the grandest and most diversified kind, first by rail along the left (east) bank of the Columbia River, here flowing in a smooth stream through a valley flanked by high hills covered with cedar and pine, as far as Arrowhead, 28 miles; thence by steamer through the Upper Arrow Lake, in the course of the Columbia, showing magnificent changing panoramas of giant mountains, forest and lake, to West Robson, 124 miles; again by rail along the north bank of the lower Kootenay River and Bonnington Falls to Nelson, a summer resort, where a night's halt was made, 68 miles.

September 8th.—Lastly, through Kootenay Lake to Kootenay landing, 55 miles, whence the journey is continued eastward by rail through similar river and mountain scenery to Fernie, centre of a local mining industry, Crow's Nest (4,410 feet), summit of the Rockies and eastern boundary of British Columbia, and Crow's Nest Mountain (7,800 feet), described as a glorious object, snowcapped and resembling the Matterhorn, but unluckily passed soon after dark; 200 miles eastward through the province of Alberta, the main Canadian Pacific Railway line is regained at Dunmore Junction.

September 9th.—This is now retraced as far as Moosejaw, *via* Medicine Hat, *q.v.*, whence a diversion is made south-east to the international boundary at Portal, and thence by the Soo line through Dakota, to St. Paul and Minneapolis.

September 10th.—Seen in daylight the United States territory here is an extensive prairie, destitute of trees, and resembling portions of the adjoining province of Saskatchewan in Canada. Further on, low bare hills are seen with some cultivation (oats) and occasional bush in the course of a river; southward again, a fine ranching country, with wheat and other cultivation, is passed, till Enderlin, an important grain depôt, is reached; also the twin cities of St. Paul and Minneapolis, in the course of a night.

September 11th.—These cities are interesting from their geographical position on the head waters of the Mississippi River, St. Paul (population 160,000), the smaller, with an extensive boot trade, being the capital of the State of Minnesota, and Minneapolis (population 200,000) being one of the great milling centres for wheat in this part of America, and indeed of the whole country. St. Paul is picturesquely situated on hilly ground, through which the river, even here of considerable size (500 to 800 yards wide), flows in a rapid current from the suburbs of Minneapolis, and is bridged in several places, at St. Paul by one of the highest and longest bridges in the country, of steel and wood. On the outskirts of St. Paul, within a small ornamental park, was shown an old Indian burial ground, with characteristic mounds, in which, while turfed and made accessible by easy paths, the original conical shape of the mounds is preserved. The site, on high ground, commands a most pleasing view of the Mississippi Valley, the river winding in a series of graceful curves between wooded islands, amid exquisite sylvan scenery.

Minneapolis is considerably larger than St. Paul, and has some good streets, also neat-looking residential suburbs in sight of wooded hills and lakes. It has a peculiar drinking water supply, distributed from a spring in bottles by means of an itinerant cart, after the manner of a soda-water factory. Both cities are seen to great advantage on the same round by means of a sight-seeing electric car, which covers a distance of 40 miles in the space of three hours for the small fee of half a dollar. The falls of Minnehaha (laughing water), shown during the sight-seeing tour in the suburbs of Minneapolis, are thus described by Longfellow in "Hiawatha," cap. iv., in fine:—

> "As one sees the Minnehaha
> Gleaming, glancing through the branches;
> As one hears the laughing water
> From behind the screen of branches."

The description still answers to the letter.

(To be continued.)

A TRIP TO NEWFOUNDLAND.

By Lieutenant-Colonel R. H. NICHOLSON.
Royal Army Medical Corps (R.)

Leaving Liverpool in the Allan liner s.s. "Laurentian," April 26th, 1905, for St. John's, Newfoundland, we met nothing of any interest on the voyage; being early in the season, very few icebergs had come down from the Arctic region, and those only very small ones. The temperature of the air off the Newfoundland coast was 32° F., and that of the water 31° F. The voyage takes seven to ten days, dependent on fogs and gales. We had a very fine voyage, and arrived at St. John's just under seven days.

The city of St. John's consists of a population of 30,000 inhabitants, a great many of Irish extraction. The houses are mostly of wood, those in Water Street, in the new part, being of stone; the original street having been partially destroyed by fire, the law made brick or stone compulsory in the rebuilding.

There is duty on most articles taken into the island, but it is refunded on all sporting articles on going out again. All food stuffs for camping out had better be bought in the island, but sporting kit had better be taken with one. Messrs. Blair, Water Street, and Mr. Bearns, the Haymarket Stores, St. John's, will supply stores; Martin, St. John's, flies.

The hotels are not up to the modern idea. I stayed at Balsam House, and was comfortable, the charge being 2 dols. to 2 dols. 50 cents a day.

On my arrival, or a few days later, there was a heavy snow-storm; and at Port Au Basque, on May 17th, the sea froze about a quarter of an inch in the night, H.M.S. "Latona" having had to return, attempting to go to the Bay of Islands off the west coast; the frosty nights continue into the middle of June.

To get to Port Au Basque I took one of the Bowering's steamers, so that I might see the coast and some of the settlements. The coast is very rugged and indented, with few trees; the people are a hardy race and gave one a welcome. From Port Au Basque I took the train to Little River and stayed at Afton Farm, and had good sport with salmon. The charge at the farm is 7 dols. per week. From there I went to the overfall on the Grand River early in June. The snow water was coming down. On June 8th I caught the first salmon on it, a fresh run fish of ten pounds; marking this spot, I gave it a rest, and on casting again,

caught a fish which turned out to be the cock, or male fish, of twelve pounds. Fish up to thirty-three pounds have been caught. At such a place as this it is necessary to camp, and one requires a man to cook, at 1 dol. 50 cents, with food such as one eats oneself. Some of the men have knowledge of where the fish lie, the flies required, &c. To a novice who cannot gaff his own fish or tie his own flies, either of the two Tompkins of Afton Farm, little Codroy River, would be very useful. Messrs. Carter and Company, Rosebery Avenue, Islington, N., and Messrs. Farlow, of the Strand, also have patterns and sizes of the flies required for salmon: the Dashwood, Jock Scott, Wilkinson, Silver Doctor, Black Dose, and Mystery are amongst the best. For trout the Montreal, Pamashenie Bell, and Very Large Black Gnat.

The trout (*Salmon fontinalis*) are a pest to the salmon fisher, taking his fly away from the salmon. My best trout was six pounds, and on one day I got seven, ranging from five and a half pounds to two pounds. My best salmon afternoon was four fish, twenty and a half pounds and three twelve-pounders, and I also lost a grilse. My total bag of salmon and trout came to nearly five hundred pounds weight, though I fished in a casual manner and many days did not go out at all.

The inhabitants were originally from Devonshire. They have left their mark in the names they gave, such as a pond for a lake, no matter how big; a brook for a large river; partridge for the ptarmigan; robin for a thrush, though labelled *Terdus migratorious* in the St. John's Museum; still in English, on the same label, appears the word "robin."

The scenery is very magnificent; hugh lakes with spruce-firs interspersed with birch trees all along their edges; this is the same along the rivers, some of which are very fine indeed, such as the river Humber.

The birds are nearly all migratory, *e.g.*, the northern-flicker, known in Newfoundland as the yellow-hammer, another misnomer; snipe breed there, but, of course, migrate in the winter, as do the geese and all birds except the ptarmigan.

The flowers are very beautiful, including ground orchids; it is a very fine country for the botanist.

I started cariboo or reindeer shooting September 15th, the season being, as far as I can remember, from that date to October 8th, when it is closed till the end of the month, as they are rutting. It opens again at the end of the month, but all details can be got from the agent to the Reid Newfoundland Railway,

St. John's, Newfoundland. The license to kill three cariboo is 50 dols. The head guide's fee is 2 dols. 50 cents a day, for which he provides tent, cooking utensils, &c.; the packer's charge is 1 dol. 50 cents a day, food in both cases being given, as well as a tot of rum now and again. For meat, cariboo is chiefly depended on. As the men have to carry the tents, &c., it is advisable to keep down the loads; the packer can always go back to the boat to fetch any article required. Allan Shears, Robinson's Head, is a very good guide.

The opening of the second season seems to be the best time for good heads, and it seems to be the time Mr. Selous and Mr. Millais select, though the late General Dashwood, who seems to have seen and known as much of Newfoundland as any man, gave it as his opinion that the stags, in consequence of having been hunted, have given up their migratory habits. The barrens on which the cariboo are found consist of a layer of peat on stone on which grow a small rhododendron, blue berries (or hurts), and partridge berries. There is no difficulty in shooting cariboo provided one keeps to leeward, but once they get one's wind it is useless to follow them, as they walk quietly though steadily away for miles.

Prohibition is the order, except in St. John's; but I did not notice any antipathy amongst the inhabitants to a peg.

Returning by the Reid Newfoundland Railway to St. John's, there were many splendid views, such as the Bay of Islands, Grand Lake, &c., and everywhere pines.

I must not forget to mention the insects. The mosquito and sand and black flies make one's life a burden, but at night they disappear to a considerable extent. A sand fly net for night, tar, and grease and oil of citronella to smear one's skin with, must not be forgotten.

Leaving St. John's in a gale, which made the passage a long one, I arrived at Glasgow on October 16th, 1905, making ten days, after a very happy, pleasant and enjoyable trip.

NOTES ON CYPRUS.

By Major B. W. LONGHURST.
Royal Army Medical Corps.

Although nowadays the odds are long against many members of our Corps being stationed in Cyprus, yet the place is so well worth a visit that some of us may like to run over there on leave from Egypt or Malta. I therefore jot down the following notes for those who may think of doing so. The hand-book on Cyprus gives one a useful idea of the topography of the island: how that it is some 50 miles from Asia Minor, about the same distance from the coast of Syria, and about 260 miles north of Port Said. It is 140 miles long and about 60 miles wide. My object is not to write a guide-book, but to collect together a few notes from personal observation that may be of interest to readers of this Journal.

First of all, how does one get to Cyprus? The best route is *viâ* Alexandria and Port Said, by the boats of the Bells Asia Minor S.S. Company, which carry the mail, and run over in two days, landing the mails at Larnaca, and then proceeding to Limassol. Another way is by the Austrian-Lloyd from Brindisi.

The island is interesting, not only on account of its great beauty, but because of its remarkable records in the history of the past.

The derivation of the word Cyprus has been attributed to the Hebrew word Kopher, Camphire or Cypress, mentioned in the song of Solomon, chapter i., verse 14, and chapter iv., verse 13, and also to the Greek word Κυπρος. The ancient name of Larnaca, a town situated on the south coast of Cyprus, is Kittim or Chittim, and this is also mentioned quite early in the Book of Genesis, for Kittim was the name of the great-grandson of Noah (see Genesis, chapter x., verse 4, also Numbers, chapter xxiv., verse 24). The land of Chittim is again referred to in the burden of Tyre (see Isaiah, chapter xxiii., verses 1 and 12). These Biblical references serve to show the great antiquity of Cyprus. Most of the great Powers in ancient times appear to have conquered Cyprus. The Island was vanquished by Egypt B.C. 1450, and the Egyptians were followed by the Phœnicians and Assyrians, and afterwards, a second time, the country was taken by Egypt, only to be followed in turn by the Persians, Romans, Arabs, and the Knights Templars, under King Richard "Cœur de Lion." After this the country passed under the Governments of Venice and Turkey, and finally came under British rule in 1878.

Since the British occupation Cyprus has been a military station of some importance, and during the time of the Egyptian war, a fairly large garrison occupied the island; now, however, there is only one company of infantry, and a few details, comprising Army Service Corps, Royal Army Medical Corps, Army Ordnance Corps and Army Pay Corps. There is only one Royal Army Medical Corps Officer stationed there at present.

The principal towns are Nicosia, the headquarters of the Government, situated in the central plain of the island, 25 miles north-west of Larnaca; Paphos, Limassol and Larnaca, towns on the south coast; Famagusta on the east; and Kyrenia on the north coast. There are a large number of ruined towns of ancient origin, and the whole country is full of interesting antiquities.

The troops are stationed in an isolated camp of wooden huts on the high ground at Polemedia, 3½ miles inland from Limassol; they remain there during the cold weather only, but as soon as the weather gets warm, the whole of the military establishment (men, women and children) moves up from Polemedia to a most delightful hill station called Tröodos,' 34 miles from Limassol, quite close to Mount Olympus, 6,406 feet above the sea.

The population of the island in 1901 was about 237,000, of which two-thirds were Greeks and one-third Turks. The languages spoken are modern Greek and Turkish.

There is a special coinage for the island: the copper piastre being the unit. A sovereign is worth 180 copper piastres. The copper coins are the 1, ½ and ¼ piastres, and the silver coins, the 3, 4½, 9 and 18 piastre pieces. English money is taken by the leading tradesmen. Najem Heuri, of Limassol, is the universal provider, and sells every kind of "Europe goods," including mineral waters.

Cyprus is not an expensive place to live in, as food is not only good but remarkably cheap, and the house rent is exceptionally low. At Polemedia there are no Government quarters for the medical officer. When I was stationed there in 1904 I paid 1s. 6d. a day rent for a fine bungalow, containing seven living rooms and the usual offices, situated in a splendid garden of about half an acre, planted with the fruit trees that grow on the island; in addition to this there was a coach-house and stabling for six horses. At Tröodos there are excellent officers' quarters, built of stone, but E. P. tents are supplied in addition, if required, and in such a climate are quite as pleasant as quarters.

There is plenty to do in the way of recreation. On the south-west of Limassol, close by the sea, there is an excellent stretch of

country for riding, good going all the way, straight ahead for five miles. Near Polemedia there is a race-course and polo ground, but, owing to the small number of officers in the station, not much use is made of the race-course. There is every facility for all the usual out-door games, and at Limassol there is an English club. The shooting in some parts of the island is good, though in many parts climbing the mountains after woodcock and partridges is distinctly hard work. Very fair snipe shooting can be obtained within easy distance of the camp at Polemedia, and the woodcock and partridges are not much farther away. There is a large salt lake near Limassol, and around the banks of this during the winter snipe and duck abound. There are also found, at different times and places on the island, wild geese, frankolins, quail, sand-grouse, bustard, and any number of hares; all of these afford excellent sport. There is no large game except the moufflon, the *Ovis ophion*, a species of wild sheep found high up in the Tröodos forests; special permission is required to shoot these, and the best rifle to use is a sporting ·303 with expanding bullet. As the rivers are all dried up in the summer time there is no fresh-water fishing, but plenty of sea fishing can be obtained, the principal fish being the red mullet and the sea bream. Sea-bathing is an attraction, and good sailing-boats can be hired.

The climate of the island is excellent. The winter in Polemedia is perfect, and the Alpine climate of Tröodos is most exhilarating and bracing in the summer, for it is over 6,000 feet high. For the troops there is no hot weather, because, as previously mentioned, they all spend the summer on Tröodos. Down in the plains near Larnaca, between the months of June and November, there is malarial fever; the prevalence of the different types, as worked out by Dr. Williamson, of Larnaca, being: tertian, 48·47; quartan, 8·03; æstivo-autumnal, 43·50.

Amongst the troops malarial fever is not common; I only saw a few cases. Very few Anopheles are found near Polemedia, and I believe none at all at Tröodos. The mosquitoes all belong to the family Culicidæ. I have, however, seen many of the true Anopheles at Perapedhi, about half way between Polemedia and Tröodos. Enteric fever is rare, and Mediterranean fever almost unknown, and there are no special diseases amongst the troops beyond those usually met with in most stations. It is interesting to note that *Bilharzia hæmatobia* and Madura foot are both found in Cyprus, and in patients who have never left the island. Dr. Williamson showed me, in Larnaca, a patient suffering from Bilharzia who had

never been out of Cyprus, and also a specimen of Madura foot found in the island. I have still in my possession microscopical specimens taken from each of these cases at the time, showing clearly the spined ovum of the Bilharzia and the *Streptothrix maduræ*. Another interesting disease is that produced by the sting of the female Sphalangi, a kind of ant (Mutilla), which conveys the anthrax bacillus, sometimes with fatal results. Dr. Williamson has described this disease in the *British Medical Journal*, and when I was in Larnaca he showed me several cases.

The poisonous snake of the country is the *Kouphi-vipera mauritanica*. The poison fang is of great length, and is really double on each side of the jaw; each fang is completely tubular, like a hypodermic needle; when out of use it lays flat along the roof of the mouth, and is only erected for the purpose of striking. In repose it is altogether hidden from view by a fold of mucous membrane; when it is erected this becomes tightly stretched over part of its anterior surface, and this serves to direct the poison down the canals in the double fang, and to prevent its escape around the exterior of the tooth. The poison canal commences on its anterior surface near the maxillary bone, and ends also on its anterior surface, a little distance from the point, which, by the bye, is as sharp as a needle; the upper orifice of the canal is in close relation with the end of the duct of the poison gland. In all the mature snakes I have dissected there have been double parallel fangs closely joined together on each side of the jaw, and, in addition, there have been also supernumerary fangs posterior to the original, the same as in the English viper. The poison, evidently, not only travels down the tubular canal in the fang, but also down the groove formed by the close apposition of the two fangs joined together laterally. I believe that this dental arrangement is different to all other viperine snakes. The Kouphi sometimes grows to a great size; it is dark brown in colour, with black bars, the head is flat and shaped like the ace of spades. There are other snakes on the island, but they are harmless. One of these, a very large black snake, is remarkable, as it is supposed to eat the Kouphi, and is in consequence encouraged to live in the neighbourhood of the native houses.

Good ponies can be obtained in Cyprus, the average price being about £8 or £10. For travelling about the island, carriages pulled by four horses abreast are used, on account of the mountainous roads. There are good roads all over the island, and a bicycle will be found most useful, as the roads are level near the coast.

There are many beautiful places to visit on the island, perhaps the most celebrated being in the vicinity of Kyrenia. About five miles east of this town, stands the glorious Premonstratensian Abbey, "De-la-Paix," or "Belle Abbaye," the view from which has been described by one of our most noted modern writers, Rider Haggard, as the most beautiful in the world. The romantic castle of St. Hilarion, or Dieu d' Amour, towering 2,200 feet above Kyrenia, is of unknown age and truly remarkable. In short, the whole island is simply teeming with interesting relics of the past, and from an archæological point of view is second only to ancient Egypt. Near Paphos may be seen the ruins of the great temple of Venus, or Aphrodite, which was built very much on the same lines as King Solomon's Temple at Jerusalem. A curious phenomenon is observable on the western shores of Cyprus, especially near Paphos and the temple of Aphrodite Anadyomene: a very slight wind carries on shore large drifts of white foam, suggesting the landing of the foam-born Goddess. Similar foam has been noticed on the edges of the Larnaca Salt Lake, charged with the eggs and bodies of microscopic insects. This remarkable phenomenon explains the origin of the fabulous legend recorded in ancient mythology.

The best time for the tourist to visit Cyprus is from October to the beginning of May. During the rest of the year the heat is rather too great in the plains for travelling in comfort. There is a good hotel at Larnaca, called "The Royal," where the tourist can stay immediately on landing, but during the hot weather it is advisable to continue the sea voyage to Limassol, stay there the night, and then proceed next morning by a four-horse carriage, ascending over 6,000 feet, to Tröodos, where there is a new hotel, most beautifully situated, not far from Mount Olympus, and where the climate is always most beautifully cool, even in the middle of summer.

Reprint.

SO-CALLED VIRULENT SYPHILIS AND ITS TREATMENT.[1]

COLONEL FRANCIS J. LAMBKIN.
Royal Army Medical Corps.

ALTHOUGH nowadays comparatively few cases of what used to be called malignant syphilis are met with compared with those which came under notice twenty years ago, still they are numerous enough to merit our keenest attention. As to the cause of this decline, it is supposed to be due chiefly to two factors: (*a*) gradual attenuation of the syphilitic virus; and (*b*) the improved methods of treatment. By malignant syphilis is generally meant that form of the disease which is associated with an indurated sore, which, probably becoming phagedænic, is followed by rupial ulceration of the skin, nodes, caries and necrosis of bone, and later by visceral lesions, cachexia, anæmia, and profound debility.

The histories of many epidemics show that the intensity of the virus of syphilis may be so great as to take on the above action irrespectively of the physical condition of the patient, attacking even those of the most robust constitution with the greatest virulence, and in spite of all treatment; but this latter s the exception. My own experience is that in the majority of cases there is present some well-marked cause which influences the progress of the disease. The following conditions, either singly or together, will generally be found to be associated in such cases: (1) poor physique; (2) living under bad hygienic and generally debilitating circumstances; (3) malaria; (4) the presence of any organic disease, especially renal; (5) alcoholism; and (6) delayed and inefficient treatment. As regards the first, it goes without saying that the poorer the constitution the less resistant it will be to the action of the syphilitic virus. Hygienic surroundings will certainly influence the progress of the disease for better or worse; thus the enervating climate of the tropics exercises a markedly baneful effect on it, while some of the worst cases are to be seen in overcrowded and dirty seaport towns. That malaria is a more potent factor in influencing syphilis for the worse than it has hitherto been given credit for is now certain, and, personally speaking, I can say that in some of the very worst cases which I have seen the patients had either been recently exposed to malaria at the time of syphilitic infection or the plasmodium could still be detected in their blood. The presence of any organic disease, especially renal, will, of course, exert a powerful influence on the pro-

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gress of any given case of syphilis, in being in itself not only a drain on the system, but also by its presence either preventing altogether or at least limiting the exhibition of specific treatment. It has long been an accepted fact, and one that is true, that the drunkard has a worse chance of resisting the syphilitic virus than the moderate drinker. The last and probably the most important of these conditions is delayed or inefficient treatment. For many years it had been an accepted maxim "that the earlier mercury was given in syphilis the more it influenced for better the future progress of the disease." Of late years this has been disputed by some of the greatest authorities, who advise that it be withheld until the appearance of secondary symptoms, the *rationale* of this being, as far as I can make out, chiefly to qualify them to be in a position definitely to assure the patient whether he has or has not syphilis; at the same time these observers state that the withholding of treatment thus does not alter the after-course of the disease. Neither to this advice nor to the latter statement can I subscribe for one moment, for I have seen several cases where a primary sore, having been allowed to heal up without specific treatment, although not followed by any of the ordinary looked-for secondary signs, was succeeded in from a year to eighteen months by some grave nervous or paralytic affection (the first indication of syphilitic infection) which would probably not have occurred if the mercury had been exhibited with the first symptom. It cannot be denied, and is only too apparent to those who have had much experience with syphilis, that withholding specific treatment, its non-continuance for any length of time, or irregular administration, are all factors which determine the disease assuming a semi-malignant character.

In dealing with the cases of virulent syphilis under consideration, the main question which arises is, What line of treatment ought to be adopted towards them? Up to a comparatively recent time such cases were looked on as more or less hopeless, so far as any specific line of treatment was concerned, and some of the greatest authorities on syphilis, notably Carmichael of Dublin, whose work on the whole subject of syphilis is classic, taught that the exhibition of mercury in them was not only contra-indicated but actually harmful, and I have not the slightest doubt but that, restricted as were the means then of introducing mercury into the system, this teaching was correct; and I can well recall more than one case in my earlier practice which not only resisted but which went from bad to worse on the exhibition of specific treatment; but it must be remembered that in those days the only really practical way we had of giving mercury was by what is known as the "internal method"—*experientia docet*—and since then we have learnt "that mercury given internally over any lengthened period in any case of syphilis, by upsetting the digestive apparatus, sooner or later brings about depletion of the system generally"; how much sooner

and with what more serious effects will it act when exhibited thus in these cases of malignant syphilis which are under consideration. However, the introduction of the modern ways of giving mercury, notably that by intramuscular injection, places us in a much stronger position to deal with, not only the ordinary cases of syphilis, but also with cases of a virulent type. Given by intramuscular injection, mercury will prove itself as beneficial in these latter as it has hitherto done in the former, that is, provided due care be exercised in regard to its dosage, and by paying strict attention to what I call its essential adjuncts. If these be adhered to mercury can be given with the greatest safety and benefit in all cases of syphilis, and I have not the slightest hesitation in saying that, if carried out properly, we would see very few of the deplorable effects of these virulent cases, and would add that, in my opinion, one of the main causes of the latter is the reprehensible practice which exists among a great many practitioners of giving mercury internally combined with potassium iodide for lengthened periods, irrespective of their syphilitic patient's condition or of his symptoms.

In discussing the treatment of these semi-malignant syphilitic cases, it will be necessary to take into consideration certain points in connection with them, points which may have the most important bearing on the former. First and foremost comes the question as to what was the probable factor in causing the disease to assume its virulence and to continue in the same groove. This may have been due to some organic disease; if so, our attention in the first instance must be riveted on it, and if possible we must endeavour to palliate it before active specific treatment is begun. Again, the condition of the constitution generally must be looked to; should it have been broken down through climatic or other depressing influences, it will require to be dealt with accordingly. The patient ought to be removed from any lowering conditions to mind and body, more especially the former, and his thoughts taken off his condition as much as possible. This is of the utmost importance, and, although very often hard to attain, it is well to keep ever in mind. As to the physical condition, nine out of ten of these cases will require feeding up with the most nourishing and wholesome diet of which we can think. Some cases are only able to assimilate meagre nourishment, when milk may be given mixed with plasmon, pure beef juice, and concentrated beef jellies. I have been using with the greatest success during the last two years ½ ounce of sanatogen three times a day, which among uneducated patients ought to be ordered in the form of medicine; if given as a food it will not be taken. Stimulants are generally called for in these cases, but must be given with care. As soon as the patient can be moved he ought to be brought into and kept as much as possible in the open air. With regard to drugs, irrespective of specifics, tonics of all sorts will be required, both mineral and vegetable, and first among them comes sarsaparilla, which ought to be given in large doses in nearly

all cases of virulent syphilis. In these cases there is often a tendency to hæmorrhages, owing probably to the non-coagulating condition of the blood. To improve this latter nothing is better than chloride of calcium given in from 10 to 30 grain doses thrice daily.

Specific treatment is, of course, the most important question to be considered in connection with these cases, and the points that arise are when to begin it, how long to persist, and when to desist with it; also as to dosage. As regards the first, a great deal will depend on the actual kind of case one has to deal with, also as to whether mercury has been given beforehand in the same case. For instance, the disease may have begun in the ordinary way—*i.e.*, a hard sore followed by one of the milder rashes, &c.—everything may have been supposed to be going on well, when a sudden outbreak of alarming symptoms takes place—rupial ulcers appear on various parts of the body, the throat becomes deeply ulcerated and the soft bones of the skull involved in caries. These are always urgent cases, and unless dealt with at once will rapidly go from bad to worse. At the same time their specific treatment calls for the greatest circumspection, and a good deal will depend on whether or not they have had mercury already and for how long. Should the above symptoms appear whilst the patient was under the effects of the drug, it will be necessary to stop it for a time and trust to general treatment, with mild sweating in hot air. Other cases may require the mercury to be increased, and a third class of case which has never yet had any mercury will require it to be rapidly exhibited. Generally speaking, most cases will require mercury and will very often do well by being given it at once in mild courses. As to dosage, the majority of cases will do best on small, I may say minute, doses. For this purpose I give a weekly intramuscular injection of $\frac{1}{2}$ a grain of metallic mercury as a maximum, never exceeding this, but very often am satisfied with $\frac{1}{4}$ or $\frac{1}{8}$ grain per week.

For the cases which require to be dealt with rapidly, such as phagedænic syphilitic chancre, intramuscular injections of calomel are best, for, although painful, it is the most active of all mercurial salts, either soluble or insoluble. Of it I give 1 grain twice a week until its physiological effects are apparent, when I substitute mercurial cream for it.

How long to persist in specific treatment? My custom is, if all goes well, to give an injection once a week for a month at a time, then desist from all specific treatment for the following month. This system of a month's active treatment alternating with one of rest can be continued for a long time. I am, of course, speaking generally, as every case must be treated on its merits. During the period of active treatment, should symptoms, as they often do, show signs of exacerbation, the mercury must be stopped for a time, when the symptoms will probably improve and one can recommence specific treatment again. These exacerbations must be carefully watched for, and their occurrence is no indication

for stopping specific treatment altogether; on the contrary, it is more the other way.

Next to specific treatment comes the important point of increasing and maintaining tissue metabolism. In these cases this is an absolute necessity, if one is to look for favourable results, and one cannot lay too much stress on it, for, beneficial as it is in an ordinary case of syphilis, it is far more in cases like those under consideration. It is the recognition of this which has doubtless been at the bottom of the success which has attended the treatment at Aachen for so many years, for there metabolism is insured by the use of the natural waters of the place, which are both diuretic and slightly aperient; likewise we see the surprising improvement which sometimes follows a course of Zeitmann's treatment, which consists, to put it briefly, of sweating, purging, with the administration of mercury for a limited number of days, and although this improvement may be only of a transient nature it shows the value of bringing about and maintaining tissue change.

There are various ways in which tissue change can be brought about, the best being with the aid of radiant heat baths, but these are not always within range. The method which for some years I have adopted, and which is the one in use in the Military Hospital, Rochester Row, is of the simplest kind. The hot air is generated by a small Bunsen stove (gas); this is placed under the chair the patient is seated on. The latter and apparatus are then enveloped, with the exception of the head of the patient, in a flannel waterproof sheet; in this way the temperature can be very readily brought up to between 160° and 200° F. The patient is allowed to remain in this for not more than five minutes, and he gets one of these baths at least every second day. As above stated, I cannot speak too highly of the necessity of insuring tissue change in all cases of syphilis; but more especially in these cases of virulent syphilis is it of the greatest importance. Besides the value of tissue metabolism in the treatment of syphilis, it must also be remembered that through it we are enabled to continue mercury more regularly and continuously than otherwise.

Iodide of potassium.—At the outset of these virulent cases of syphilis iodide of potassium is of little avail and does more harm than good; but as the case progresses its efficacy is far more marked than in a similar stage of an ordinary case of syphilis. No doubt as with mercury so with potassium iodide; it has to some extent been brought into disrepute through the far too reprehensible practice that exists of giving it as a matter of course, either by itself or in conjunction with mercury, in all cases of syphilis, with little reference to the patient's condition or progress. In these virulent cases iodide of potash must be given with great care and circumspection. It should be given in intermittent courses of increasing doses for not more than ten days at a time; if continued beyond this it appears to lose its beneficial effects, and then

only acts as a constitutional depressant, which is the last thing to be desired. Given in the way suggested iodide of potassium is most valuable in virulent syphilis, mitigating in a most marvellous way the various bone and skin lesions, to say nothing of the later syphilitic affections.

Iodipin.—This is used as a substitute for potassium iodide. It is a combination of iodine and sesame oil. It is prepared in two strengths —*i.e.*, a 10 per cent., which has been given internally in gelatin capsules, and a 25 per cent., which is the usual preparation used. It is given hypodermically in doses of from 15 to 20 cubic centimetres for ten consecutive days. The syringe used for these injections must be capable of holding at least ten cubic centimetres, and the needle should be fairly long (eight centimetres) with a large bore. Iodipin is a viscid fluid which will require to be heated to at least body temperature before being injected. The advantages claimed for iodipin over iodide of potassium are that it is more slowly absorbed and very much more slowly excreted, besides acting without being a depressant or interfering with the digestion. The injections are non-toxic and quite painless. I have had a good deal of experience with this drug and I may say that I am very favourably impressed with it, more especially in the cases under consideration.

Iodegelatin.—This is a similar preparation to the above, and I saw it extensively used in Milan and Pavia, where it was spoken very highly of. It is certainly clean and more easily used than iodipin.

Local lesions.—For chronic lesions of the mucous membrane nothing is better, taking it generally, than chromic acid and its solutions. A good procedure is to paint the lesion first with a 5 to 10 per cent. solution of chromic acid and immediately afterwards apply either the solid stick or a 30 per cent. solution of nitrate of silver; this forms chromate of silver.

To some of the severe mucous ulcers acid nitrate of mercury is the best application; this to be applied every fifth day. For phagedænic sores I find nothing better than the application of crude chromic acid; this is especially the case in phagedænic sores attacking the glans penis. The tissue of the glans will be rapidly destroyed unless urgent measures are at once taken. The patient ought to be put under an anæsthetic and the crude chromic acid applied; a black slough will result which can be removed by poulticing with charcoal. The chromic application may need to be resorted to more than once and should be continued until all tissue destruction has disappeared. Acid nitrate of mercury and nitric acid fort. are also useful. After separation of the slough iodoform dusted on is best. Some ulcers are best treated by continual bathing in hot boric or sublimate solutions, but all large chronic ulcers are to be treated on general surgical principles, *i.e.*, rest, cleansing, opening up sockets and sinuses, and securing good drainage; for gummata soothing application at first and later some stimulating preparation. Bone lesions are always

troublesome and will need constant attention to prevent serious disfigurement; at first soothing applications are best; should ulceration take place scraping with a Volkmann's scoop ought to be resorted to. The early removal of a sequestrum ought always to be attempted.

The following are the notes of some cases of what would be classified as "virulent," but it will be seen that in the majority of them the disease assumed the severity as the result of some other cause rather than of the inherent intensity of the virus of syphilis itself.

Case 1.—The patient was admitted into the Military Hospital, Rochester Row, on September 9th, 1905, as a free patient, having been discharged from the Service as "permanently unfit." He had contracted a primary sore at Poona, India, in August, 1904; this was followed in a fortnight's time by a secondary eruption on the face. Soon rupial sores appeared on the legs, the shoulders, and the arms, and a large ulcer attacked the upper lip, which it very soon destroyed. The patient had remained in hospital until March, 1905, when he was invalided home to Netley. There, although his general health improved somewhat, he remained very cachectic and anæmic, whilst ulceration proceeded at different points. On arrival at Rochester Row Military Hospital the patient, who was much debilitated, was cachectic and anæmic. His weight was 7 st. His face was a mass of old and fresh ulceration, the upper lip was entirely destroyed, and he was badly scarred all over.

According to the syphilitic case sheet, whilst in India the patient had received two intramuscular injections of one-third of a grain of a solution of perchloride of mercury which caused such pain and swelling that this line of treatment was abandoned, and henceforth he was treated mostly by the internal administration of a solution of perchloride of mercury and iodide of potassium. At Netley iodide of potassium was freely given, and he went through one course of Zeitmann's treatment (with doubtful result). At Rochester Row Military Hospital for the first fortnight all specific treatment was stopped, he was put on the most generous diet he could take, and with this was given one ounce of sanatogen daily. He was given a hot air bath every second day to facilitate tissue change and eliminate any accumulation of mercury which might be present. At the end of the fortnight he received an intramuscular injection of one-third of a grain of metallic mercury once a week, and this line of treatment, together with intermittent courses of iodide of potassium, was continued for three months, when he was discharged from hospital apparently free from the disease. During his stay at Rochester Row Military Hospital he increased his weight by 2 st., and his general health improved in a wonderful way. Local applications of acid nitrate of mercury and chromic acid 40 grains to the ounce were made to the ulcers. The probable cause of the severity of this case was poor con-

stitutional physique, added to debility at the end of a spell of hot weather in India.

Case 2.—The patient was admitted to the Military Hospital, Rochester Row, on September 9th, 1905, from the Royal Victoria Hospital, Netley. He had contracted a sore at Poona, India, in November, 1903. The sore was shortly followed by a badly ulcerated throat, and the mouth and gums became involved and the two front teeth of the upper jaw fell out. He was invalided home to Netley in March, 1904, when, although the throat continued to give trouble, no fresh symptoms developed until November, 1904, when an ulcer formed on the upper lip which spread to the nose, the alæ of which it rapidly destroyed, and at the same time the palate bone began to necrose. Serpiginous ulcers developed on the face, the legs, and the arms. Under treatment the progress of the disease had been more or less checked. On admission at Rochester Row Military Hospital his condition was as follows:—There was a profound cachexia with great debility, the alæ of the nose and the upper lip were entirely destroyed, the palate and the nasal bones were exfoliating, and the ulceration was still present on the face, the scalp, the arms, and the legs.

The treatment in India had consisted almost entirely of the administration of iodide of potassium, as it was stated that "any attempt at giving mercury had to be abandoned," owing to the ill-effects which it had. At Netley, besides the internal administration of mercury and iodide of potassium, the patient had gone through four courses of Zeitmann's treatment, which latter was said "not to have been very successful," as although the patient improved for the time, he rapidly relapsed. At Rochester Row Military Hospital, to begin with, all specific treatment was stopped, he was given a hot-air bath every second day, a generous diet with 1 ounce of sanatogen daily, together with sarsaparilla, malt, and cod-liver oil, and later he received a weekly intramuscular injection, beginning with $\frac{1}{3}$ of a grain of metallic mercury, and this was eventually increased to 1 grain per week. A sequestrum from the palate bone was removed, and all ulcers were treated locally. The patient made an excellent recovery, and after being fitted with a palate and false nose was discharged from hospital on February 27th, 1906. During his stay in hospital he had gained nearly 3 st. in weight.

In this case it is hard to account for the disease becoming so virulent, as the patient was of good physique, and bore an excellent character. One peculiarity is to be noted, viz., the virulent relapse which took place after the patient had been under treatment at home and doing well for some months.

Case 3.—The patient was admitted into the Military Hospital, Rochester Row, from Netley, on September 9th, 1905. He had contracted a primary sore at Hong-Kong in November, 1902. No signs of secondary infection appeared until June, 1903, when he was quartered at

Singapore, where rupial ulcers developed on the legs and the body. It may be mentioned that he had suffered much from malarial fever both in Hong-Kong and at Singapore. Whilst he was at the latter station he was continually in and out of hospital, the ulcers healing up, and breaking out again and again; he became very debilitated, and was invalided home to Netley in June, 1904. Whilst he was there the ulceration continued, and extended to the face and the scalp, and the tongue became deeply ulcerated; debility and cachexia were well marked. On arrival at Rochester Row Military Hospital, ulceration was found to be still present on the body and the face, and especially on the tongue, which was much thickened. The patient had great difficulty in taking any food on account of the pain; there was much debility. Whilst in hospital at Rochester Row he had frequent attacks of ague, and plasmodium was detected in the blood. His weight was 8 st.

At Singapore mercury and iodide of potassium had been given internally in combination for various periods; at Netley the same drugs had been administered with four courses of Zeitmann's treatment (the latter appears to have done good for a time, but the patient relapsed very soon after each course). At Rochester Row Military Hospital full courses of quinine and hot-air baths were given, and the patient was put on as nourishing diet as he could take with 1 ounce of sanatogen and chloride of calcium in 20 grain doses thrice daily; afterwards a weekly intramuscular injection of mercurial cream was ordered, commencing with ½ a grain, finally rising to 1 grain. He was also given intermittent courses of iodide of potassium, 60 grains per day. He underwent two courses of ten days of iodipin. The ulcers were treated locally with chromic acid, 40 grains to 1 ounce. The patient made an uninterrupted recovery, and was discharged from hospital on February 1st, 1906, apparently well. His weight on discharge was 10 st. 7 lbs.

There is every reason to believe that the presence of malaria was the cause of the disease taking on the virulence it did in this case. Quinine worked wonders in the cure.

Case 4.—The patient was admitted into the Military Hospital, Rochester Row, from Netley, on September 9th, 1905. The history of this case is an instructive one. The patient had contracted a sore whilst serving in India in 1892, which was followed later by eruptions on the face and the back. Under treatment these disappeared. He had no further sign for three years, when the little toe of the left foot became swollen and painful; this finally resulted in the metatarsal bone of the toe having to be removed. He was sent home and invalided out of the Service in 1896. In the interim, until 1901, he was employed as a railway porter, during which time he remained in good health, having had no return of the disease. In 1901 he re-enlisted and was sent to Malta. In July, 1902, a swelling appeared on the right malar bone,

which subsided under specific treatment but reappeared in March, 1903; suppuration set in, necrosis of bone resulted and the malar bone was removed. Then the nasal bone became similarly affected, and the bridge of the nose fell in. He was invalided home to Netley at the end of 1903, when ulceration and necrosis of the frontal and palate bones set in and an operation for removal of the sequestrum was performed. He was eventually invalided out of the Service and was transferred to Rochester Row Military Hospital for further treatment. The patient's condition on admission at the latter hospital was one of debility and great emaciation, with cachexia and anæmia. His weight was 8 st. The bridge of the nose and the right malar bone were destroyed. Necrosis was still proceeding in the skull (right parietal) and palate bones. The stench from this patient was overpowering.

Nothing could be learnt as to the treatment adopted so long ago as 1892, but at Malta in 1902 the patient had had mercury internally and by vapour bath, and also large doses of iodide of potassium. At Netley specific treatment had been given internally and by inunction, as well as six courses of Zeitmann's treatment. At Rochester Row Military Hospital the treatment consisted, first, of tonics, hot-air baths, good nourishing diet, with sanatogen and sarsaparilla. Afterwards the patient received regularly a weekly injection of metallic mercury, half a grain rising to one grain; iodide of potassium appearing to aggravate the symptoms, he received ten subcutaneous injections of iodipin. The palate bone was removed, the right parietal was scraped, and chromic acid was applied. A good recovery was made and the patient left the hospital on February 10th, 1906, in comparatively good health. He had gained 2 st. 7 lbs. in weight whilst at Rochester Row Military Hospital.

The chief point of interest in this case is the fact of the disease having remained practically dormant from 1896 to 1902, when it re-asserted itself on the patient being exposed to the enervating climate of a summer in Malta. The man evidently had never had any prolonged or thorough course of treatment, and it goes to prove once more the absolute necessity of this in all cases. This patient's physique was very good.

Case 5.—The patient was transferred from Netley to the Military Hospital at Rochester Row, on February 19th, 1906. He had contracted a primary sore at Rangoon in February, 1904, which was followed by a roseolar rash, and this was succeeded in a month's time by rupia, which latter appeared on the body and the face; at the same time both knee-joints became painful and swollen. After some months the patient became so debilitated and cachectic that he was sent home to Netley, where he arrived on December 31st, 1904. His condition on admission to Rochester Row Military Hospital showed great debility and cachexia.

Both the knees were swollen and partially ankylosed, and there were scars of ulcers scattered over the body, whilst rupial ulceration was still proceeding over the face and the nose, the latter lesion resembling lupus. The patient's weight was 8 st.

The syphilis case sheet showed that whilst he was at Rangoon the patient had had some injections of perchloride of mercury, which, however, were stopped on account of the pain which they caused, and mercury in combination with iodide of potassium was given internally for some months. At Netley he had had several courses of Zeitmann's treatment. (Transfer certificates stated: "Not much benefited by it.") At Rochester Row Military Hospital, to begin with, all specific treatment was stopped, hot-air baths, tonics, generous diet with sanatogen and sarsaparilla being substituted; later, a weekly intramuscular injection of one grain of metallic mercury was given regularly, and he received one course of iodipin (subcutaneously), 20 cubic centimetres per day for ten days. In a month's time he had made good progress towards recovery; the ulceration on the face had ceased, and he had gained 8 lbs. in weight. At the time of writing the patient looks, and apparently is, in robust health, and is awaiting his discharge from the hospital. The mercurial injections are still continued.

In this case there was no apparent reason why the disease should have taken on the malignant character which it did.

Case 6.—The patient was admitted into the Military Hospital, Rochester Row, from Netley, on February 19th, 1906. He had contracted a primary sore at Delhi in March, 1904, which was followed almost at once by rupial ulceration on the body and the legs, pericolitis, cachexia, and general debility. He was in hospital for a year, more or less, when he was sent home to Netley, where he arrived in May, 1905. Then besides other troubles he got orchitis of both testicles (the right being removed).

On admission at Rochester Row Military Hospital the patient's condition was bad; he was much debilitated, cachectic, and emaciated, his weight being 7 st. 7 lbs. He was suffering from ozæna and ulceration of the nasal septum. The remaining testicle was much enlarged and was hard and painful.

In India the patient had had various courses of mercury, by inunction, and by administration internally, in combination with iodide of potassium. At Netley tonics, &c., with iodide of potassium, had been given, and the patient had gone through four courses of Zeitmann's treatment. At Rochester Row Military Hospital the treatment had consisted primarily of hot-air baths, hypophosphates, and sarsaparilla, with generous diet and sanatogen, and later of weekly intramuscular injections of mercurial cream and a regular course of iodipin. The patient made a good recovery, putting on weight from the first. The ozæna ceased, the ulceration

healed, and the remaining testicle became gradually reduced in size, and all pain and tenderness went from it. The patient was discharged on May 22nd, 1906, his weight then being 9 st. 7 lbs.

The severity of the disease in this case was probably very much influenced by the patient's wretched physique, added to enervating climatic conditions.

CASE 7.—The patient was admitted to the Military Hospital, Rochester Row, from Netley, on February 19th, 1906. He had contracted a phagedænic sore at Barbados in July, 1904, which was soon followed by general rupial ulceration over the body and the limbs. These conditions were soon followed by asthenia with consequent anæmia, emaciation, and general debility. He was sent home to Netley in November, 1904. Then ulceration continued and the nasal and palate bones became involved. On admission at Rochester Row Military Hospital the patient's condition was one of gravity. His weight was 6 st. 7 lbs. He was quite bedridden. There were rupial ulcers on the body and the face, and caries of nasal and palate bones. The right knee was ankylosed, swollen, and painful. Asthenia, anæmia, and extreme emaciation and debility prevailed, and there was deep ulceration of the pharynx.

The treatment in Barbados had consisted of alternating courses of mercury by inunction and internally, the latter combined with iodide of potassium. At Netley, besides tonics, &c., the patient had undergone six courses of Zeitmann's treatment (which appeared to do good for the time being, but relapse taking place almost at once). At Rochester Row Military Hospital the patient was first of all treated with hot-air baths, sarsaparilla, malt and cod-liver oil, and generous diet, with sanatogen. Later he received a weekly injection of a quarter of a grain of metallic mercury, and had one course of iodipin. He made good progress, but the ulceration of the throat threw him back. He is doing well again now, but his is a bad case. He suffered much from epistaxis, for which he was given 20 grains of chloride of calcium three times a day.

This patient's physique was of the poorest possible kind, which made him an easy prey to syphilis, especially when the virus was of a virulent type from the beginning.

CASE 8.—The patient was admitted into the Military Hospital, Rochester Row, from Netley, on February 19th, 1906; he had contracted a sore at Agra in April, 1904, which was followed by a papular eruption on the body and the face a few weeks later. A few rupial sores appeared on the face in six months. The septum of the nose began to ulcerate and the patient got much run down and debilitated. The palate bone then became engaged, as also the nasal bone, and necrosis proceeded rapidly, and both bones were soon destroyed. At Netley the necrosis continued, destroying the whole of the palate bones and partly the ethmoid bone. The patient was in a most lamentable condition when

admitted to Rochester Row Military Hospital, half his face being destroyed, and the base of the skull being exposed. Ulceration was still proceeding and there was naturally much debility and emaciation.

The patient stated that he had had injections of mercury in India (this is not certain), and much mercury and iodide of potassium internally. At Netley he had had six courses of Zeitmann's treatment with various local applications to the ulcerating surfaces. At Rochester Row Military Hospital the treatment consisted of hot-air baths, tonics, and generous diet, with sanatogen, sarsaparilla, and iodide of potassium, and later of very small weekly injections of mercurial cream. The patient has made simply wonderful improvement and has practically recovered, but his disfigurement presents one of the worst cases I have ever seen. He has gained 2 st. in weight since admission.

The severity of this case can be traced to debility during the excessively hot weather at Agra throughout the summer in which he contracted the disease.

Case 9.—The patient, who was admitted to the Military Hospital, Rochester Row, from Netley, on October 27th, 1905, had contracted a hard sore at Maymeyo, Burmah, on April 28th, 1904. Three months later a papular rash appeared on the body, and this became rapidly pustular; the patient went from bad to worse, and suffered severely also from malarial fever. He remained in hospital for some months, was then embarked for England, but on reaching Bombay had to be taken into hospital owing to extreme debility. There he remained for about two months, when he was sent home to Netley, where he arrived on January 20th, 1906. At Netley his condition was marked by debility and cachexia, and there was rupial ulceration on the back and on the limbs. The left knee was swollen and painful. On admission at Rochester Row Military Hospital he was quite bedridden; he was very anæmic and cachectic, there were ulceration of the septum of the nose and pharynx, and rupial ulcers on the buttocks, and the left knee was stiff and painful.

In Burmah the patient had had mercury by inunction and internally, combined with iodide of potassium, whilst at Bombay he had received injections of perchloride of mercury, which he stated were stopped on account of the pain which they caused. At Netley iodide of potassium, with mercury internally, had been administered, and the patient had gone through two courses of Zeitmann's treatment. At Rochester Row Military Hospital at first all specific treatment was stopped, and tonics, sarsaparilla, and hot-air baths were substituted, and good diet, with 1 oz. of sanatogen per day, was ordered. Later weekly injections of metallic mercury were given and two courses of iodipin. The patient made a slow but steady recovery. Quinine was also given in continued doses before the mercury.

No doubt in this case malaria was the chief factor in causing the disease to assume its severity.

Case 10.—The patient was admitted into the Military Hospital, Rochester Row, from Netley, for further treatment on February 19th, 1906. The history of the case showed that the patient had contracted a primary sore at Sheybo, Burma, in July, 1904, which had been followed in three weeks' time by a sore throat and a copper-coloured rash on the body, and later by rupial ulceration on the trunk, great wasting and general debility. He was sent home to Netley on February 2nd, 1905, where his chief trouble consisted of painful nodules on the shins and the clavicles. When admitted to Rochester Row Military Hospital he was bedridden and cachectic, and in an emaciated condition. His weight was 8 st. Rupial ulcers were scattered over the body and there were nodules on both shins, which were very painful.

The teatment in Burma consisted of the internal administration of mercury combined with iodide of potassium, tonics, &c. At Netley, besides other treatment, the patient went through four courses of Zeitmann's treatment (which apparently did some good for a time). At Rochester Row Military Hospital the treatment first of all consisted of hot-air baths, tonics, sarsaparilla, malt and cod-liver oil, with the best diet that he could take, and sanatogen. Later, mercurial injections, 1 grain, were administered weekly. The patient had one course of iodipin by subcutaneous injection. He made an excellent recovery whilst in hospital, gained 2 st. in weight, and was discharged apparently fit on April 15th, 1906.

This man was of intemperate habits, which might easily have accounted for the severity of his case.

The above ten cases will suffice to illustrate what is nowadays known as "virulent syphilis." It will be noticed that in each of them a factor other than the actual virulence of the poison itself can be distinctly traced, and the extreme importance of this as a guide in the treatment of the case is clearly brought out. They further go to show how amenable even this class of case is to treatment carried out on scientific and systematic lines.

The happy results attained are most encouraging, and lend a hope that in the intramuscular method of treating syphilis we are in possession of a most effective weapon for successfully dealing with not only ordinary cases of the disease, but also (when modified as above described) with those of a virulent nature.

Reviews.

HYGIÈNE MILITAIRE (vol. ix. of TRAITÉ D'HYGIÈNE, edited by Professor Brouardel and Dr. Mosny). By Dr. J. Rouget and Dr. C. Dopter. Paris: Baillière et Fils, 1907.

ACCORDING to popular conception, military hygiene is merely the application of the principles of general hygiene to the life of the soldier; the able treatises that have been written by successive professors of the subject in our own Army Medical School encourage that view. Yet Edmund Parkes, the first Professor of Hygiene in this or in any country, was a professor, not of general, but of military hygiene. It was in the camps and barracks of the soldier, in field service, and in tropical and unhealthy climates, that the lessons of disease prevention were first learned, and it may be truly said that the science of hygiene would not have attained the important position which it now holds in relation to the private and public life of the people, without the opportunities which the conditions of military service in all parts of the world afforded for studying the origin and spread of disease and the efficiency of the measures taken to prevent it. In Germany, for example, it is freely acknowledged to-day, that national military service has been the chief factor in raising the standard of sanitation throughout the country.

We may go further and say that the great discoveries of recent times in connection with the etiology of disease have been due to the work of military hygienists. We have pre-eminent examples of this in the discovery of facts that have altered the whole science of disease prevention, in the case of malarial fevers, yellow fever, Mediterranean fever, and sleeping sickness, diseases which affect a very large proportion of the human race. We look, therefore, in a work on military hygiene, not only for instruction in the application of general principles to the special conditions of the soldier's life, but also for recognition of the historical facts upon which many of these principles are based, and by which their special application must be governed.

The subject has excited a considerable amount of interest in recent years, chiefly on account of the outbreaks of disease in the American camps in 1898, and amongst the British troops in South Africa, as well as by the widespread reports of the absence of such outbreaks in the recent campaign in Manchuria. Several volumes on military hygiene have consequently appeared within the last year or two. Munson's bulky volume was the first to arrive. It has been followed by publications in England, Germany and France. The volume under review is the latest. It bears on its title-page the year 1907 as the year of publication.

It is the ninth of a series of twenty volumes of the "Traité d'Hygiène," which was commenced this year under the direction of Professor Brouardel and Dr. Mosny, and which has been continued, after Professor Brouardel's lamented death, by Professor Chantemesse and Dr. Mosny. Volumes v., vi., and vii. have not yet appeared, but the first four and the eighth and tenth have, so that this is the seventh issued during the current year. Both authors are army medical officers and assistant professors at the

Val-de-Grâce. They are also the authors of the volume on "Hygiène d'Alimentation," which is the fourth of the series, and they may, therefore, be accepted as writers who have special experience of their subject.

From the historical point of view their treatment of it does not come up to our expectations. The lessons of history must be impressed in the case of military hygiene ten times more forcibly than in the case of the hygiene of civil life. War strips life of its artificial conditions and makes it approach more nearly to the natural, and it is under natural conditions that history repeats itself. No work on military hygiene, therefore, should omit to emphasise the experiences of the past, the causes that led up to them, and the results of efforts to control them. Otherwise the military hygienist is apt to forget the dangers that lie in front of him, and to be unprepared for them when they come. Yet in this respect the authors' crop of references is meagre, although the field is vast and fertile. They have not gathered as much as they might from the sowings of their own country, and when they go further afield, they are not always careful as to what they glean. For example, in dealing with the results of recruiting, and in illustrating the wise and suggestive remark that "l'armée sera ce que la fera le recrutement," they state that during the South African War we had to take men where we could get them. This may be true, but they add that, in consequence, the admissions and deaths from disease were never so high amongst British troops. No doubt that was the impression which most people had at the time, but it is not true. In fact, it is very far from the truth, and one may express a feeling of regret that in recent years the tendency has been to accept, in matters connected with the lessons of war, evidence which in other scientific investigations would have been unhesitatingly rejected or received with extreme caution. Drs. Rouget and Dopter are not the only members of a scientific profession who have been falling recently into the error of not going more closely into their sources of information.

On the other hand, one is very favourably impressed with the manner in which they have dealt with military hygiene as a distinctive subject. It has become highly specialised in their hands, and there is scarcely a sentence in the 350 pages of their work which will be found in volumes on general hygiene. In this respect the volume is the best of its kind. It is full of detail, and no one who peruses it can fail to be impressed with the fact that a very special knowledge and training are necessary for the hygienist who is called upon to undertake the duties of preventing sickness among soldiers and of maintaining an army in the highest condition of fitness and of power to resist disease.

The volume commences with some suggestive pages on military pathology, in which the circumstances of military life, such as age, agglomeration and herding of individuals together, diet and work, marching, camp life and military operations are discussed with a view to establishing the fact that the soldier is exposed in a very special manner to morbific influences. This is followed by sections dealing with physical standards, tests and examination of recruits; with the soldier's ration in all its aspect, his clothing, equipment and training; with personal hygiene; with the hygiene and construction of barracks, their water supplies and accessory buildings, such as latrines, kitchens, baths, recreation rooms, stables, guard-rooms, regimental sick-rooms, and so on; with the hygiene of camps, cantonments and bivouacs; with military hospitals in peace,

in war and in the colonies; and finally, with the prophylactic measures for the prevention of disease in armies, including methods of investigating, notifying and isolating epidemic disease, immunisation, disinfection, cleansing of battlefields and destruction of refuse. In doing so, the authors have given us an instructive and valuable account of the views held in the French army on these subjects, of the regulations in force and of the manner in which they have been modified in recent years. It is perhaps a defect that the practice in other countries is not more closely followed. Occasionally, too, by taking a restricted view, they are led into making statements that might put the student off his guard. For example, the influence of scurvy as a disease of armies is minimised. At the present time, they say, it seems to be of much less importance than formerly, for, since the Crimean War, when the admissions were considerable, it has ceased to occur ("on ne l'a pas vu survenir"). In reality, scurvy was one of the chief causes that led to the capitulation of Port Arthur in the beginning of 1905.

Apart, however, from historical defects such as these, the volume is full of significant remarks, practical details, descriptions of apparatus and explanations of regulations, which make it especially valuable as a work of reference. The military hygienist who studies its pages, will be led to take a wider view of his subject than if he confines his attention entirely to the practice and experience of his own country. In many respects the French practice differs from ours. For example, in the physical examination of recruits, standards and equivalents are used only as a guide. The examining medical officer is left to exercise his own judgment in regard to them and does not reject a recruit who fails to come up to the equivalents of height, weight and chest measurement unless other facts give them significance. The authors discuss this question very fully, and there are some other differences between the French practice and ours which are well worth studying.

Unfortunately the volume has no index and the sections are not separated into distinctive chapters. This detracts somewhat from the value of a work which has many points in its favour and which can be thoroughly recommended as a practical guide.

W. G. M.

THE USES OF THE RÖNTGEN RAYS IN GENERAL PRACTICE. By R. Higham Cooper. London: Baillière, Tindall and Cox, 1906. 2s. 6d. net.

The author in the preface to this manual states that his intention is to give the general practitioner some idea of the help he may get in his practice from the use of X-rays. In this he has succeeded clearly and briefly. Many of the books published on this subject contain too much extraneous matter, rendering it a task of no mean magnitude when perusing their contents to get instruction on any given point. Mr. Cooper's manual stands out in bold contradistinction, and constitutes a handy and easily understood little book on the subject. Naturally, in so small a book, the actual physics are, as he states, reduced to a minimum, but, in our opinion, sufficient is given for all practical purposes. Chapter iv. is particularly interesting and useful, and must prove of great assistance to the general practitioner who may decide on doing his own X-ray work.

We can confidently recommend Mr. Cooper's manual as a real assistance, not alone to the beginner, but also to the average worker.

F. BRUCE.

High Frequency Currents. By H. Evelyn Crook. London : Baillière, Tindall and Cox, 1906. 7s. 6d. net.

The use of high frequency currents in the treatment of disease has of late years increased so enormously, that the methods of application have become an important study for the medical man who may desire to make use of them in his practice. This branch of electrical science is essentially medical work for obvious reasons, and ought never to be delegated to the non-professional further than the working of the instruments. The medical adviser who may have to requisition the use of apparatus belonging to a non-professional should be present during the administration of the treatment and see that the patient receives the correct amount of dosage. Heretofore, the means of becoming acquainted with the procedure were difficult to acquire, hence quacks did lucrative business. Now there is no excuse for this want of knowledge, for Mr. Crook has compiled a treatise which may be read and understood by any one. His description and uses of the component parts of the apparatus leave nothing to be desired, and interested medical men may now know that the halo of mystery which seemed to surround a high frequency apparatus has been cleared away by Mr. Crook.

We anticipate that this work will be classed as a text-book on the subject of high frequency currents, hence Mr. Crook is to be congratulated on so admirably supplying a long-felt want by adding to the literature appertaining to this branch of electrical treatment.

F. Bruce.

Current Literature.

Notes on New Materials for Sanitation.—This interesting and useful paper, contributed to the *Royal Engineers' Journal* for November, 1906, by Lieutenant P. O. G. Usborne, R.E., is intended to describe "a few of the most modern and useful devices for ensuring cleanliness and ornamentation." The remarks on "Terrazzo" are particularly useful, as the superstition that this flooring material can only be laid by experts has prevented its being used in many cases in which it would have been most useful.

Lieutenant Usborne omits one device for preventing cracks in "Terrazzo," and that is to lay it in comparatively small squares, say two to three yards, divided by bands of marble a few inches wide. For halls and broad passages this expedient has the extra advantage of being extremely ornamental.

The various tiles and paints referred to are of interest, especially as showing the great advances made in late years in the provision of wall and floor surfaces of an impervious and yet not too expensive nature.

Anti-cholera Inoculations in India.—In the *Bulletin de l'Institut Pasteur* for September 15th and 30th, 1906, Professor W. M. Haffkine gives the results of his protective vaccinations against cholera, extending over many years. He first describes Dr. James Ferran's discovery of an

attenuated virus which was used as a vaccine against cholera in 1885, and gives the reasons why the prophylactic value of these inoculations was not satisfactorily established.

In 1888 fresh hopes in this direction were raised as the results of the labours of Dr. Gamaleia, of Odessa; but the *Vibrio Metchnikowi*, which he discovered and named, was soon found to be entirely different to the true Asiatic human cholera germ.

In 1890 Professor Haffkine specially studied the problem at the Institut Pasteur at Paris, and at first experienced great difficulty in obtaining a typical vibrio as regards its pathogenic and specific properties, and in maintaining this germ in a fixed and determinable state so as to render it capable of an uninterrupted succession of passages through animals. This problem was solved on the discovery that a temporary aeration of the virus whilst "in passage" increased its pathogenic action; by proceeding on these lines he succeeded in obtaining an exudate which gave invariable results. This virus, being constant, was now employed for his immunising experiments in an attenuated form, followed by a stronger injection. On July 18th, 1892, Haffkine made his first human inoculation, by injecting into his own side a dose of the milder vaccine, which was followed by a slight febrile reaction; six days later he inoculated himself in the opposite side with the stronger choleraic virus, and this injection was also followed by a febrile condition, which entirely disappeared on the third day. The experiment was now repeated on about sixty people, with similar results. The problem now consisted in ascertaining whether these vaccines were of value in protecting against cholera as found in Nature, and as Southern Asia appeared to offer the most favourable field for these experiments, Haffkine embarked for India in February, 1893, and at first met with far more difficulties than even he had anticipated. It was not until March, 1894, that he was able to intervene in an epidemic which had broken out in a restricted area in Calcutta. Out of a population of 200 inhabitants, 116 were induced to undergo vaccination, all of whom escaped cholera, whilst amongst the unvaccinated ten cases contracted the disease, and of these seven died. This fortunate beginning gained many partisans to the cause, but the next two or three experiments were not quite so entirely favourable, chiefly because the correct dose to be injected had not yet been determined.

Haffkine's first campaign against cholera lasted twenty-nine months (April, 1893, to August, 1895), during which period he inoculated 42,197 individuals, viz., 10,127 military and 32,070 civilians. About two-thirds of the total number received the double inoculation, the remainder only undergoing the first injection. As the Professor's health now broke down, he had to return to Europe for some months, but he came back to India the following year (February, 1896), and he now pursued his studies up to the time that the appearance of bubonic plague imperatively called him to other labours. About 30,000 people were inoculated during this period, and the results were grouped into three categories: (1) Cases in which the proportion of persons inoculated, or where the cholera cases which occurred amongst the population, were too few to afford a proof; (2) cases with definite results, but only slightly favourable; (3) definite and satisfactory results.

Up to 1895 Haffkine always made use of the double vaccination; the first vaccine was (as already stated) a culture attenuated by the oxygen of

the air; the second vaccine was a virus intensified by passages. As about one-third of the individuals inoculated with the milder vaccine did not put in an appearance on the day for re-inoculation, this suggested the question as to whether the method could possibly be simplified by a single inoculation of the stronger virus, and to test this method practically he persuaded Dr. Arthur Powell to inoculate him with a treble dose of the living passage virus. As this gave rise to no serious consequences, Powell then injected 1,123 individuals employed on the tea plantations at Catchar, with no untoward results.

The conclusions arrived at by Haffkine are as follows: (1) The protective effect of anti-cholera vaccine commences soon after the operation, and increases rapidly for the first four days, and lasts for about fourteen months, after which it rapidly diminishes and probably disappears completely. By using larger doses a more lasting protection would appear to be assured. (2) During the period of its activity, the vaccine reduces the number of cases amongst those protected to less than a tenth of those occurring amongst the unvaccinated. (3) The mortality of those who contract the disease, whether vaccinated or unvaccinated, differs but little, and the course of the disease would appear to be unaffected by the previous inoculation.

J. E. NICHOLSON,
Lieutenant-Colonel (*R.P.*).

Anti-plague Inoculations.—In the *Bulletin de l'Institut Pasteur* for October 30th, 1906, Professor W. M. Haffkine gives a *résumé* of his work on the prophylactic treatment of plague in India. After an interval of sixty years, during which the plains of India had been free from plague, this disease appeared in the autumn of 1896 in Bombay, and thence gradually spread over a large portion of India; from its outbreak up to the end of last year, over four million deaths from this disease had been officially registered, but even this vast number is probably but a fraction only of the total deaths due to plague. It can therefore be readily seen how important it is to discover a means for insuring immunity against this scourge.

The possibility of fighting such an epidemic with an army of bacteriologists sufficiently skilled in the preparation and handling of living cultures was out of the question; so Haffkine directed his researches towards obtaining chemical or dead preparations which could be sent to a distance, supplied to any operator, or stored up until required. After many experiments, the most efficacious preparation was found to be one made from the pulp of organs sterilised by desiccation, but this was a very dangerous one to use; sterilisation of cultures by heat was the simplest and safest method, but unfortunately the virus was thus deprived of nearly all immunising power; however, the preparation which gave least promise at first eventually proved itself to be the true means for arresting the spread of the disease among the population attacked.

Haffkine had first to determine the form in which his vaccine lymph should be prepared, and he decided to commence with old cultures in a liquid medium, in accordance with the results derived from his researches on anti-cholera vaccinations. He further conjectured that possibly, by combining the bodies of microbes with the products accumulated in the liquid of old cultures, he would thus succeed in producing a combined

immunity in man; the best results were obtained from cultures in peptonised bouillon, to which a trace of fatty matter had been added, and from bacilli which underwent involution forms, or were derived from "stalactite formations." The dose was determined by the maximum quantity of each series of cultures which, when injected into a human being, caused no marked depression from his general physiological condition: the maximum reaction should not cause a rise of temperature exceeding 101° to 102° F.

On January 10th, 1897, Haffkine made the first experiment with this prophylactic lymph on his own person, receiving an injection of 5 cc. into each side. The dose was afterwards fixed at 2½ cc., so that he thus received right away an amount which later on was equivalent to four normal doses. The symptoms closely resembled those which followed the anti-cholera vaccination, and (although more severe by reason of the high dose) were equally transient. His example was followed by the *personnel* of his laboratory, by the Principal and the Professors of the School of Medicine, and by a certain number of European and native notabilities, and within the month several hundreds of individuals underwent this treatment; towards the end of the month a fairly serious epidemic of plague broke out in the Byculla House of Correction at Bombay, and Haffkine offered his services, which were accepted.

Prior to the date (January 30th, 1897) of the inoculations at the House of Correction, there had been nine cases of plague with five deaths, and on that same morning six fresh cases occurred, of which three eventually died. The vaccinations took place that same afternoon, 154 out of 337 submitting to the treatment; the non-inoculated showed twelve cases with six deaths, the inoculated had only two cases with no deaths; each prisoner inoculated had received 3 cc. of culture, and all showed symptoms of vaccine reaction, but with the exception of those who developed plague, all were out of danger on the third day. This experiment was soon followed by a lengthy series of others, gradually increasing in scale of magnitude, but the results furnished by the Byculla experiment were soon rapidly confirmed.

Towards the end of December, 1897, plague had broken out in the Umarkadi Common Jail, at Bombay. By this time about 8,000 individuals amongst the free population of Bombay had been inoculated; the prisoners had heard of this and all were ready to submit to treatment, but as this method was still in the experimental stage, on January 1st, 1898, Haffkine only vaccinated every second individual, taken at random. Both inoculated and non-inoculated were allowed to mix freely and return to their various occupations, no difference of treatment being shown to either class. The results were: 127 non-inoculated showed ten cases with six deaths; 147 inoculated showed three cases but no death. Since this time, the practice has been to consider the anti-plague inoculation as being on the same footing as ordinary vaccination against small-pox, and the whole of the population in many of the prisons in the Bombay Presidency were inoculated as soon as a case of plague appeared therein, and the results were entirely satisfactory.

The same success as to results was also obtained amongst the free population. To quote only one example, an official report published at Lahore in 1904 contains particulars as to the villages of twelve districts

in which the proportion of the inoculated was highest; the following numbers sum up these results:—

Among 639,630 non-inoculated,	49,433	cases	(7·7 %),	29,733 deaths	(4·7 %)
,, 186,797 inoculated,	3,399	,,	(1·8 %),	814 ,,	(0·4 %)

The number of cases was thus reduced to less than one-fourth, the proportion of deaths to cases to less than one-half, and the total death-rate from plague to less than one-tenth of what it was amongst the non-inoculated.

During the later operations in the Punjaub a comparison was made between the immunising effects of microbic bodies obtained from gelatine cultures and those from old bouillon cultures; the former showed the proportion of deaths to cases as being 34·6 per cent., the latter had only 23·3 per cent., whilst amongst the non-inoculated the same rate was 60·48 per cent. The old bouillon cultures were therefore more efficient than the young gelatine cultures emulsionised and heated up to 65° C. about one month before use.

Haffkine remarks on the rapidity with which anti-plague inoculation produces its immunising effect, and especially on the possibility of thus arresting the incubation of the disease, or of favourably influencing its progress, in persons already infected. He also notes that the white or European race is physiologically less sensitive to plague than are the natives of India, and he surmises that possibly this is the reason why protection conferred by inoculation is higher and more lasting in the European.

J. E. Nicholson,
Lieutenant-Colonel (R.P.).

Silver Spirochæte.—In the *Berliner Klinische Wochenschrift* of September 10th, 1906, Dr. Walter Schulze gives an account of his observations on the staining of tissue from healthy animals by the silver process. The tissue studied was the suprarenal capsules and pancreas of healthy rabbits. He employed the method of Levaditti. He states: "In well-stained portions of the specimen a number of dark-stained thicker connective tissue threads stand out from the light brown back; grounds; partly arising from these, but for the most part isolated, one sees fine black bundles which follow generally, like the vessels and nerves, the direction of the interstitial tissue. These fine black threads are in the form of corkscrew-like spirals. They correspond fully in their size, shape and general formation with the descriptions given of the *Spirochæte pallida* in the tissues stained by this process, but the above are found not in syphilitic, but *in perfectly healthy*, tissue."

He repeated the experiments of Bertarelli, who observed, in a series of experiments in which he inoculated syphilitic material into the anterior chamber of the eye of rabbits, the *S. pallida* in the tissue of the eye of these rabbits after treatment by the silver process. Schulze repeated these experiments, using, however, ordinary dirt from the street, instead of syphilitic material, for injection into the anterior chamber of the eye of albino rabbits. A hypopyon-keratitis developed. After three weeks the inflammation subsided. The eye was then excised and treated with Sihler's maceration fluid and afterwards with the silver process. He observed in the tissue of this eye structures identical with those described by Bertarelli as *S. pallida*. He gives photograms of these

structures, and the resemblance to *S. pallida* is very striking. The exact nature of these structures has not been determined, but Schulze is inclined to regard them as terminal nerve fibres.

Schulze states, "that before the use of the silver method, when smear preparations of the internal organs of syphilitics were made and stained by the Giemsa method, no Spirochæte were found, whilst in the specific ulcers and neighbouring lymphatic glands they were found in a certain percentage of cases. Now, by the silver process, they are found in large numbers in the suprarenal capsules, liver, &c." Also that as result of his experiments on the eye of rabbits he has come to the conclusion that structures described by Bertarelli in the eye of infected rabbits and confirmed by Schaudinn as *S. pallida* are only portions of tissue.

This important contribution to the study of the etiology of syphilis should have the effect of restraining observers from arriving at too hasty conclusions as to the presence or absence of *S. pallida* in tissue stained by the silver process.

E. D. W. Greig.

Correspondence.

A LITTLE KNOWN TREATMENT FOR SUNSTOKE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In the December number of our Journal for 1906, Captain Foulds has drawn attention to the value of frequent enemata of iced water in cases of sunstroke, a method of treatment which he believes is but little known. Is that so? To the senior officers of our Corps, at all events, I feel sure the treatment must be familiar, for Surgeon-General Maclean, at Netley, in his impressive lectures on Tropical Medicine, was accustomed to dwell upon the high value of enemata of ice-cold water as an adjunct to the general treatment of sunstroke; and on referring to my notes, made in 1872, when a probationer at Netley, I find a note to this effect, "the introduction of enemata of iced water in the treatment of sunstroke was due to a suggestion made by Professor E. Parkes."

I am, &c.,
R. H. Quill,
Surgeon-General, P.M.O. Netley.

ERRATA.

Vol. VII., No. 6, December, 1906: "Preventive Medicine in the Army," by Major A. Pearse, R.A.M.C., page 585, line 4 of the last paragraph, and page 586, line 2, for the words "Commanding in charge" read "Commanding-in-Chief."

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Original Communications.

SOME OBSERVATIONS ON THE MORPHOLOGY AND BIOLOGY OF *MICROCOCCUS MELITENSIS*.

BY J. W. H. EYRE, M.D.

[THE following notes summarise observations carried out in the Bacteriological Laboratories of the Medical Schools of Charing Cross Hospital and of Guy's Hospital during the eight years from 1899 to 1906, during which period I have at various times received much valuable assistance from Staff-Surgeon (now Fleet-Surgeon) Stenhouse, Staff-Surgeons Dalton and Duncan, and Captain R. Tilbury Brown, R.A.M.C., and to each of these indefatigable workers I take the present opportunity of expressing my sense of indebtedness.]

I.—MORPHOLOGY.

The *Micrococcus melitensis* (vel *Brucei*) as it occurs in Nature is extremely small, and when observed in hanging drop preparations occurs as a minute spherical coccus not exceeding 0·4 μ in diameter, or of a slightly ovoid cell measuring 0·4 μ by 0·3 μ, arranged singly or in pairs, or more rarely in short chains of four elements. In stained preparations the size is somewhat less (fig. 1), the cocci averaging 0·3 μ in diameter (Bruce, 0·33 μ). In broth cultivations of from one to two weeks' growth it is not uncommon to find longer chains numbering some ten to fourteen individuals. Chains of this length, however, lack cohesion and consequently are never seen in stained preparations. Many writers describe a "bacillary" form

of this micro-organism of which the length is from two to four times as great as the breadth (these forms are said to be most frequently obtained in old gelatine cultivations grown at the room temperature), or refer to it as a "cocco-bacillus," while some contend that it is a true bacillus. These statements appear to be based on the appearances occasionally observed in stained preparations of artificial cultivations, which should, in the writer's opinion, be interpreted in a totally different manner—that is to say, these so-called bacillary forms properly belong to one of two classes :—

(1) Elongated cocci, undergoing binary division, in which fission is as yet incomplete. These are found in stained preparations of young cultures (not in the hanging drop preparations, for the then connecting band of protoplasm remains invisible), and can readily be demonstrated by allowing the cover-slip film of emulsion to dry very slowly, taking say ten to fifteen minutes over the drying process, staining with weak thionin blue or gentian violet, and after washing again allowing the preparation to dry slowly. In such a film every gradation will be seen, from the diplococcus through the bipolar staining cell to the evenly-stained cylindrical form with rounded or oval ends, to which the terms cocco-bacillus or ovoid bacillus have been applied. A control preparation from the same emulsion rapidly dried over the flame and fixed, stained, and, after washing, again rapidly dried, will show nothing but cocci and diplococci, as the more rapid contraction of the cell protoplasm is sufficient to rupture the connecting band between two adjacent cells.

(2) True (but living) involution forms, of irregular shape and size, often approximating closely to the cylindrical form of the typical bacillus, but as often distorted, oval and pear-shaped, only met with in old cultivations, or in cultivations upon or in media of unsuitable reaction, and similar to those forms met with in, for example, cultivations of streptococci under comparable conditions.

Finally, this bacillary form is never met with in film or hanging drop preparations made direct from animal tissues.

Capsule formation is absent, spore formation is never observed.

II.—Motility and Flagella.

In hanging drop preparations the organism exhibits very active and vigorous Brownian, or molecular or vibratory movement, but true locomotion—the translation of individual cocci from one part

of the field to another—is entirely absent. Gordon,[1] staining film preparations from old cultivations by a modified Van Emengen method, claims to have demonstrated flagella, varying in number from one to four, on the majority of the cocci, but other observers, including Durham, Zammit, and the writer, have been totally unable to confirm his observations.

III.—Staining Reactions.

The micrococcus stains well with all the ordinary basic aniline dyes—methylene blue, fuchsin, or neutral red give the best results—it does not, however, retain the stain when treated by Gram's method, but holds only the contrast stain.

IV.—Atmosphere, Temperature, &c.

Atmosphere.—*M. melitensis* is a facultative anaerobe, it is true, but its rate of growth when deprived of a free supply of oxygen is very considerably diminished. When cultivated in an atmosphere of nitrogen—that is, in atmospheric air from which the oxygen has been abstracted by the action of alkaline pyro, and in which a slight negative pressure exists—many days elapse before the colonies on agar plates are visible to the naked eye, and two or even three weeks' incubation are needed before they attain the same size as those grown on control aerobic plates for seven days only.

Temperature.—The upper and lower limits of temperature at which growth of *M. melitensis* takes place are 45° C. and 6° C. Above the former and below the latter points growth ceases. The "optimum" temperature is 36·8° C. to 37° C. From the "optimum" up to 42° C. growth suffers but little diminution in rate, but from 42° C. up to 45° C. growth is sensibly affected in the directions of slowing and in the increase of involution forms. From 36° C. down to the room temperature (18° to 22° C.) the micrococcus suffers a progressive decrease in rapidity of growth, accompanied by a gradual increase in the number of involution forms present in the cultures.

Rate of Growth.—*M. melitensis* is, on the whole, a slowly growing organism when cultivated direct from the animal body—or in or upon artificial media of unsuitable reaction—the visibility of the colonies under these circumstances usually being delayed to the third or fourth day. In some instances, if sufficient infective material is planted, a good growth can be obtained direct from the animal tissues in a remarkably short time, twenty-four to thirty-six

[1] *Lancet*, 1899, i. (688).

hours, and when this happens the influence of the reaction of the medium upon the resulting growth is well shown. Growth in broth is also slow. Subcultivations, however, even upon the ordinary laboratory agar (+ 10), can be readily made to yield luxuriant growth within twenty-four hours.

Reaction of Medium.—The extremes of reaction of artificial media in which the micrococcus can be cultivated are, – 7·5 and + 15 (Eyre's scale), at which points growth is extremely scanty and slow. For all ordinary purposes + 10 will be found sufficiently near the optimum reaction, but when rapid and luxuriant growth is desired from material obtained direct from animal tissues the optimum reaction of + 8 must be employed. The following extracts from the laboratory notebook showing date of appearance of colonies on agars of different reactions sufficiently emphasise this point :—

A.—Two mg. of brain substance from guinea-pig 25B were suspended in 10 cc. normal saline solution, and one loopful of the resulting emulsion was employed to inseminate, in series, three plates of each batch of reaction agar. The plates were incubated aerobically at 37° C., until the termination of the observations. In the following tables the sign + indicates growth visible to the naked eye, and the numbers refer to the three plates in the order of planting.

Reaction of medium	Period of Observation				
	24 hours	48 hours	72 hours	96 hours	120 hours
+ 2·5	..	..	..	+ 1	+ 1, 2, 3
+ 5	..	+ 1	+ 1, 2, 3	+ 1, 2, 3	+ 1, 2, 3
+ 8	..	+ 1	+ 1, 2, 3	+ 1, 2, 3	+ 1, 2, 3
+ 10	..	..	+ 1	+ 1, 2	+ 1, 2, 3
+ 12·5	..	..	..	..	+ 1, 2, 3

Reaction of medium	Period of Observation					Total number of colonies on plate
	24 hours	36 to 40 hours	48 hours	72 hours	96 hours	
+ 2·5	..	..	..	..	+	3
+ 5	..	..	+	+	+	30
+ 8	+	+	+	+	+	150
+ 10	..	+	+	+	+	100

B.—A similar experiment using cerebral tissue from guinea-pig 26 as the infective material. Here the number of cocci present per loopful of emulsion was very much smaller, and the first plate

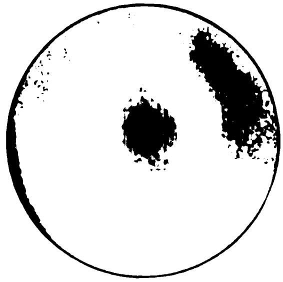

FIG. 1.—*M. Melitensis*, Deep Colony, Glycerine Agar, 3 days at 37° C. × 15.

FIG. 2.—*M. Melitensis*, Superficial Colony, Glycerine Agar, 3 days at 37° C. × 15.

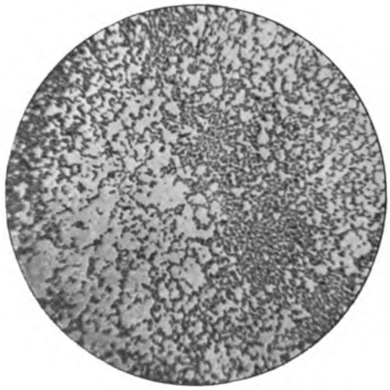

FIG. 3.—*M. Melitensis*, 3 days Glycerine Agar at 37° C., stained Carbolic Fuchsin. × 1,000.

To illustrate article by J. W. H. EYRE, M.D.

"Some Observations on the Morphology and Biology of *Micrococcus Melitensis*."

of each series was countable. Plates 2 and 3 in each series were discarded as they showed no growth up to the end of seven days.

V.—Cultural Characters.

Note.—Unless otherwise stated the appearances are described from cultivations upon ordinary laboratory media (+ 10), after incubation aerobically at 37° C.

Agar Plates.—Growth present in crowded plates at twenty-four to thirty-six hours produces a ground-glass appearance on the surface of the medium, sometimes visible to the naked eye, usually only seen with the ⅔ inch objective. At forty-eight to seventy-two hours discrete colonies, resembling minute drops of water, are visible. The size of the colonies is inversely proportional to the number present in a plate, and when moderately numerous—say 100 to a plate—attain a diameter of 1·5 mm. at the end of a week. When only two to ten colonies are present in a plate a diameter of 3·5 mm. is not unusual; the measurement of the colonies developing in a series of plate dilutions showing well the influence of abundance of food as compared with proximity and over-crowding on the ultimate size of the individual colonies.

The following experiment shows the point well. Two mg. of cerebral tissue from guinea-pig 25C were emulsified in 10 cc. of normal saline solution, and one loopful of the emulsion employed to inseminate in series nine agar plates (+ 8). These were incubated for twenty-one days under aerobic conditions in an incubator running at 37° C., the atmosphere of which was kept saturated with moisture. The result of the observations was as follows:—

Plate 1	Innumerable minute colonies.		
,, 2	,, ,, ,,		
,, 3	1,275 colonies—averaging less than 0·5 mm. diameter.		
,, 4	530	,,	,, ,, 0·75 ,,
,, 5	40	,,	comprising 15 of 1·5 mm., 17 of 2 mm., and 8 of 2·5 mm. diameter.
,, 6	20	,,	,, 18 of 2 mm., and 2 of 2·5 mm. diameter.
,, 7	12	,,	,, 2 of 2·5 mm., 5 of 3 mm., 1 of 3·5 mm., and 4 of 4 mm. diameter.
,, 8	1	,,	5 mm. diameter.
,, 9	*Nil.*		

The individual colonies are round, nearly circular in shape; surface colonies, convex to pulvinate, occasionally umbonate; deep colonies biconvex, edge entire, structure finely and regularly granular, surface smooth. In the centre of each colony is a darker portion of sharply defined oval shape, better seen in the deep than

in the surface colonies (figs. 2 and 3). No lines, grooves or other structural markings can be seen, although in old colonies the central portion may become more coarsely granular or even grumose.

Colonies when young are translucent. After about four days' growth they become opaque whitish, with a slight opalescence by reflected light, and pale yellow to pale amber by transmitted light. With age the colour passes from rich amber to light brown or even dirty slate brown.

Glycerine Agar.—As above.

Nutrose Litmus Agar.—This medium serves fairly well for the purposes of isolation when prepared from meat essence; if prepared from ox serum[1] and made to a reaction of + 8 it forms the *optimum medium* for the growth of the coccus. The appearance of the colonies is identical with that described above; the reaction of the litmus remains unchanged.

[Agar prepared from a watery extract of either spleen or brain tissue, in place of the ordinary Fleischwasser, is a good medium for the cultivation of the micrococcus, but the growth thereon exhibits no essential differences from those described above. According to Zammit, the organism grows well on an agared solution of normal fæces, but will not develop upon an agar medium prepared from sea water, even when heavily contaminated with human excrement.]

Agar Tube Culture Smear and Streak.—The growth at first consists of discrete colonies limited to the needle track; these rapidly coalesce to form masses and bands of raised, moist, shining growth, at first pale yellow to amber in colour, then passing with age to a distinct brown, like the colour of glue.

Blood Serum (Inspissated).—A white, moist growth, similar to the above.

Blood Serum (Fluid).—In this medium growth usually takes place as a fine flocculent deposit, the bulk of the fluid remaining perfectly clear, and only rarely as a diffused turbidity.

Alkali Albumen Jelly (Lorrain Smith).—A very scanty growth of minute discrete colonies, not appearing under three to four days, and which do not attain any great size, the medium being too alkaline to afford a favourable soil.

Gelatine Plate Cultivation.—At 22° C. the coccus is extremely slow of growth. Practically nothing can be seen with the naked eye until about the end of a week, although the colonies can be seen by the aid of a $\frac{2}{3}$-inch lens by the fourth or fifth day. In

[1] *Transactions of the Pathological Society.*

character and appearance the colonies are identical with those described under agar plate. No liquefaction of the medium takes place even at the end of a month, by which time, if the gelatine has been prevented from drying, the colonies average some 2 mm. in diameter.

Gelatine Streak or Smear Culture.—At 22° C. the growth is restricted to the path of the inoculating needle, and if a fairly large amount of infective material has been sown the growth is visible by the third or fourth day. It resembles the growth upon agar, but is drier. Microscopically, elongated involution forms are often present after about three weeks' growth.

Gelatine Stab at 22° *C.*—Growth in the form of minute discrete spherical and biconvex colonies, resembling the deep colonies in agar, is visible along the entire course of the stab in about five days. At the end of a fortnight those in the upper part of the needle track have increased in size, are yellowish-brown in colour and coarsely granular, and a few beaded out-growths may be noted in this situation.

Gelatine (*Fluid*).—Growth readily takes place in 10 per cent. gelatine liquefied by heat, and incubated at the body temperature, in the form of a white flocculent deposit, the bulk of the medium remaining clear. Some strains of *M. melitensis*, stricter aerobes than the majority, render the upper layers of the gelatine uniformly turbid, but the growth soon sinks to the bottom of the tube or flask, and multiplication practically ceases after about ten days.

Nutrient Broth.—Growth first appears towards the end of the second day as a diffuse turbidity, and by seventy-two hours the growths in the upper layers of the fluid are denser than those below. Towards the end of a week the rate of growth has slowed and a white deposit has begun to form, whilst after a month or so the bulk of the medium is almost clear, and the deposit, consisting chiefly of short chains easily broken up, has considerably increased. At no period is any pellicle formed.

Peptone Salt Solution (not Standardised).—Scanty growth. Indol absent up to the end of twenty-eight days.

Nitrate Broth (not Standardised).—Scanty growth. No reduction of nitrates to nitrites.

Lead Broth (not Standardised).—Scanty growth. No precipitation of lead sulphide.

Bile Salt Broth (not Standardised).—Growth; no apparent change in the reaction of the medium.

Proskauer and Capaldi's Solution (not Standardised) *No.* 1.—No growth.

Proskauer and Capaldi's Solution (not Standardised) *No.* 2.—Growth; no apparent change in the reaction of the medium.

Neutral Litmus Whey.—Growth. Production of an alkaline reaction in twenty-four to forty-eight hours, which increases until the end of a week; it is then equivalent to from 0·2 to 0·3 per cent. of $\frac{n}{10}H_2SO_4$.

Litmus Milk.—Luxuriant growth takes place in this medium. No change whatever is produced in the consistence of the milk, but the formation of alkali goes on rapidly, and by the end of four or five days has caused the litmus to assume a distinct blue colour. This production of an alkaline reaction is much more marked when using goat's milk as the medium than when cow's milk is employed. Microscopically, the cocci present in milk are rather larger than those observed in other media, except potato.

Potato.—Growth on ordinary potato culture is visible to the naked eye only as a moist area on the surface of the medium—the so-called "invisible" growth—and is never very luxuriant. Upon alkaline potato growth is more vigorous, and appears as a moist film, whitish to pale yellow in colour, by the end of four or five days. Microscopically, the cocci are larger than those grown on agar, tend to chain formation, and are associated with numerous involution forms.

Carbohydrate Media (not Standardised).—Composed of distilled water in which is dissolved 1 per cent. Witte's peptone, and 1 per cent. of the appropriate carbohydrate, and tinted with neutral litmus-solution, previous to tubing and sterilising.

Lævulose media Galactose media Maltose media Saccharose media Rafinose media Mannite media Dulcite media Dextrine media Inulin media	Growth takes place, but is not accompanied by the production of gas or of alteration in reaction.
Dextrose media Lactose media	Growth takes place accompanied by the production of a faint alkaline reaction at the end of a week.

VI.—Resistance.

The experiments referred to under this heading were carried out with each of five different strains of *M. melitensis*, and were repeated many times in order to obtain consistent average results.

(1) *Moist Heat.*—The thermal death-point from the average of five different strains suspended in watery emulsions, under standard conditions, with a time exposure of ten minutes, was found by Dalton and the writer[1] to be 57·5° C.

[1] *Journ. of Hygiene*, iv., 1904 (157).

(2) *Dry Heat.*—The same five strains, similarly emulsified, then dried upon sterile cover-slips and exposed to dry heat with a time exposure of ten minutes, gave a death-point varying from 90° to 95° C. with the different strains.

(3) *Desiccation.*—All these strains of *M. melitensis* resisted drying for long periods (see also VII., Vitality). Working with emulsions subsequently dried in a Müller's desiccator on cover-slips, oncigarette or filter paper, cotton-wool and strips of linen, Duncan and I were successful in obtaining subcultures from these materials up to the twenty-first day. Short lengths of yarn soaked in the emulsions, then dried, yielded growth up to the end of the third month (ninety days), but every attempt to obtain subcultures during the fourteenth or fifteenth weeks failed completely.

(4) *Chemical Reagents.*—In the first instance the resistance of the micrococcus to perchloride of mercury and to carbolic acid was tested by a modification of the drop method; that is to say, a definite quantity of emulsion of the coccus (0·1 cc.) was added to 5 cc. of the test disinfectant, and after short contact periods 0·1 cc. of the mixture was plated on agar; after fifteen, thirty and sixty minutes' exposure, two, three, or even ten such 0·1 cc. plates were poured as seemed desirable. The plates were incubated for seven days at 37° C., and the total number of the colonies present in the plates enumerated, the cocci present per cubic centimetre calculated therefrom and recorded. A tenth of a cubic centimetre of the emulsion, added to 5 cc. of distilled water, served as a control. An average result is tabulated below, and shows that 1 per cent. phenol and 1 in 2,000 hydrarg. perchlor. are both able to destroy the coccus in watery emulsion within fifteen minutes.

Disinfectant	Period of Contact						
	2½ mins.	5 mins.	10 mins.	15 mins.	30 mins.	60 mins.	120 mins.
$HgCl_2$ 1 in 2,000 ..	16	2	2	0	0	0	0
$HgCl_2$ 1 in 1,000 ..	0	0	0	0	0	0	0
Phenol 1 in 200 ..	8,600	3,300	2,900	1,200	624	22	0
Phenol 1 in 100 ..	117	75	7	0	0	0	0
Distilled water ..	64,000	64,000	64,000	64,000	30,000	12,000	2,800

Working on the question of the comparative values of Clayton gas and of sulphur dioxide for the disinfection of ship's holds, Wade and the writer found that Clayton gas supplied to a hold at an average percentage of 1·2 per cent. sulphur dioxide for a period of four and three-quarter hours was sufficient to destroy all the samples

of *M. melitensis* (dried on cigarette paper and on cotton-wool) which had been distributed throughout the cargo in the experimental hold; 0·7 per cent. liquid sulphur dioxide supplied to the hold for a period of five hours was equally efficient; higher percentages were found to be equally efficient in shorter periods, *e.g.*, 2·5 per cent. SO_2, in the shape of Clayton gas for three hours, or 3·2 per cent. liquid SO_2 for two and a half hours.[1]

VII.—Vitality.

M. melitensis retains its vitality for considerable periods in artificial cultivations, even when no particular precautions have been taken to retard evaporation from the medium. Successful subcultivations have been recorded by Shaw from agar cultures two hundred and seventy-six days old, broth cultures one hundred and seventy-three days old, and litmus milk cultures one hundred and forty-four days old. Kennedy successfully established a subcultivation from a litmus milk culture two hundred and eighty-four days old.

A batch of agar cultivations of *M. melitensis*, prepared in Malta under date November 5th, 1902 (and originally sealed with paraffin wax), were received at Guy's Hospital, where they were kept in the cool incubator (22° C.), and subcultivations prepared as required. On September 22nd, 1904, a successful subcultivation was established from the last remaining tube of the batch when the medium was dry and shrivelled (by Duncan), and on February 12th, 1905 (several unsuccessful attempts having been made between these two dates), nutrient broth was poured into the tube, and after incubation at 37° C. for three days, plates were prepared from the now turbid broth. A scanty growth of *M. melitensis*, was obtained a few days later (Eyre). These two periods of six hundred and eighty-seven and eight hundred and thirty days sufficiently indicate the longevity of *M. melitensis* when undisturbed, even when not placed under the most favourable conditions.

When cultivated in large two-litre flasks of sea water (previously sterilised by filtration through porcelain filters, not by boiling or autoclaving) the coccus was found by Stenhouse and the writer to retain its vitality up to the end of seven weeks (forty-two days), and during the first seventeen to twenty days to show evidence of slight multiplication in that medium.

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[1] Report to the Local Government Board on "Further Experiments on Sulphur Dioxide, as Applied in the Destruction of Rats and in Disinfection on Shipboard," by Dr. Wade, No. 232, May 7, 1906.

ENTERIC FEVER IN AMBALA, 1880-1905.

By Lieutenant-Colonel S. GLENN ALLEN.
Royal Army Medical Corps.'

Seeing that "prevention" rather than "cure" of disease is now recognised as the first and chief duty of the military medical officer, it must be a matter of personal concern to us all that a preventable disease, enteric fever, continues to hold, year after year, such a prominent position amongst the causes of sickness and mortality of the British Army in India. Although I cannot claim to have had any long experience of the disease in this country, my attention was drawn to the enteric fever problem almost from the day of my arrival (October, 1904), as not only did my station, Ambala, afford special facilities for its study, but also, being appointed a special sanitary officer for the district, I had the advantage of taking part in a strenuous campaign, which the Senior Medical Officer, Lieutenant-Colonel T. P. Woodhouse, R.A.M.C., had entered upon, with the express object of removing this long-existing cause of reproach from the otherwise fair (sanitary) fame of Ambala.

It would certainly have been difficult to find any station where a special effort of this kind was more urgently called for, or one, be it said, where the prospects of success were, at the time, less promising; nevertheless, the unexpected has happened, and the garrison which showed in 1903 the highest admission-rate (per mille), as regards British troops, for enteric fever in all India, is now practically free from the disease. The results obtained are, indeed, so striking, and form such an encouraging contrast to anything that the past history of this, or probably any, cantonment can show (thanks chiefly, it is only fair to say, to the great sanitary zeal and energy displayed by the present Senior Medical Officer), that I have been led to write this chapter of our medical history in the hope that this record of our past failures and recent success may give aid and encouragement wherever enteric fever still bids defiance to the forces of sanitation.

Before entering, however, upon a description of the sanitary methods employed at Ambala, it will be desirable to show to what extent and for what length of time enteric fever had been prevalent amongst the British troops, and to indicate the chief causes to which we attribute our frequent epidemics in past years. In this way not only will others be in a position to appreciate fully what

has been, and therefore can be, effected by appropriate sanitary means, even under the most unpromising conditions, but I shall also, I trust, escape all danger of being held guilty of presumption in having suggested that any such good thing as a successful system of prevention of enteric fever could come out of Ambala.

The subject will be most conveniently dealt with under the three following headings:—

A.—Period of disease prevalence, 1880 to 1904, inclusive; (*a*) period of special prevalence, 1895 to 1904.

B.—Period of disease reduction, or *contrast year*, 1905.

C.—Causes of enteric fever at Ambala and factors concerned in its propagation, together with the sanitary methods and measures by which a reduction in disease incidence has been effected.

TABLE OF ADMISSIONS AND DEATHS FROM ENTERIC FEVER AMONGST BRITISH TROOPS AT AMBALA FOR TWENTY-SIX YEARS (1880 TO 1905).

Year	Average strength	Admissions	Deaths	Ratio per 1,000 of strength		
				Admissions	Deaths	
1880	1,337	10	3	7·5	2·24	
1881	1,630	5	3	3·1	1·84	
1882	1,750	2	2	1·1	1·14	
1883	1,751	9	3	5·1	1·71	
1884	1,600	18	1	11·3	·63	
1885	1,474	12	2	8·1	1·36	
1886	1,958	38	11	19·4	5·62	
1887	1,914	8	3	4·2	1·57	
1888	1,947	15	3	7·7	1·54	
1889	1,999	37	2	18·5	1·0	
1890	2,036	27	8	13·3	3·95	
1891	1,632	26	10	15·9	6·13	
1892	1,921	42	9	21·9	4·69	
1893	2,176	78	23	35·8	10·57	
1894	1,911	68	20	35.6	10·47	
1895	**2,101**	**86**	**17**	**40·9**	**8·09**	Period of special prevalence
1896	**2,023**	**49**	**14**	**24·2**	**6·92**	
1897	**2,154**	**138**	**33**	**64·1**	**15·32**	
1898	**1,896**	**67**	**25**	**35·3**	**13·19**	
1899	**1,783**	**57**	**16**	**32·0**	**8·97**	
1900	**1,471**	**21**	**6**	**14·3**	**4·08**	
1901	**1,224**	**24**	**10**	**19·6**	**8·7**	
1902	**1,274**	**55**	**9**	**43·2**	**7·06**	
1903	**2,164**	**107**	**21**	**49·4**	**9·70**	
1904	**2,579**	**105**	**24**	**40·7**	**9·31**	
CONTRAST YEAR.						
1905	2,314	12	3	5·1	1·3	

Note.—I desire to thank Captain E. Blake Knox, R.A.M.C., Secretary to the Principal Medical Officer, India, for the above table.

A.—Period of Disease Prevalence.

As a matter of interest, and to show for what a length of time enteric fever has been continuously present, I attach a table (p. 124) giving the actual number of admissions and deaths, and also the ratios per 1,000 of the same, for each year from 1880 to 1904 inclusive. I shall not, however, attempt a detailed examination of the whole of this long period; it will be sufficient for my purpose to take the years (1895-1904) immediately prior to the contrast year, 1905, contenting myself with a general survey of the whole of the period of prevalence.

General Survey.—The first point of interest to note is that not a single year has passed in which the disease has failed to appear, nor one in which it has not caused the loss of at least one life. As regards actual cases and deaths, the following table shows the greatest and smallest numbers we have had and in which years.

Cases			Deaths		
Year	Maximum	Minimum	Year	Maximum	Minimum
1897	138	—	1897 ..	33	—
1882	—	2	1884 ..	—	1

The total admissions (1880-1904) number 1,104, or a yearly average of 44·16, and the deaths number 278, or a yearly average of over eleven, practically one a month.

The next point of importance is that, comparing the second half of this quarter century with the first, the disease has been, on the whole, increasing. This is accounted for in part, no doubt, by greater accuracy of diagnosis of late years; but even allowing for this, there is a distinct evidence of increased prevalence, with a higher case-mortality. Having taken this short survey, let us now pass to the more detailed examination.

Detailed Examination.—We notice that this period, 1895-1904, of enteric fever prevalence is roughly divisible into three sub-periods:—

(1) *A sub-period of five years* (1895-1899) marked throughout, with the exception of 1896, by great but unequal prevalence of enteric fever in spite of a decrease in the British garrison during the last two years. In the middle year (1897) the sick and death ratios reached their maximum, there having been no less than 138 cases and 33 deaths, equalling an admission ratio of 64, and a mortality ratio of over 15 per 1,000 of strength.

(2) *The second and shortest sub-period* (1900-1901), during which there was a sudden decrease in the sick-rate for enteric fever. The admission-rates per 1,000 show a remarkable fall from 32 per 1,000 in 1899 to 14·3 per 1,000 in 1900, and 19·6 per 1,000 in 1901. As regards 1901, however, it is noticeable that the death-rate was higher than for any other year of the whole series, there having been as many as ten deaths amongst 24 cases. It should be added that during this period the British garrison was much below the average strength.

(3) *The third and last sub-period,* comprising the years 1902, 1903 and 1904, is marked by a sudden and great recrudescence of the disease, especially in the years 1902 and 1903. During the latter, indeed, it increased so greatly that the admissions (ratio per 1,000 of strength) exceeded every previous year of the whole series except 1897.

The object of this examination of the table by sub-periods is to show that there was some exceptional influence at work during this period of ten years which affected the average sick-rate in two directions: (*a*) by reducing it far below the average figures in 1900 and 1901; (*b*) by raising it to a more than average height for the three subsequent years.

This outside influence was, of course, the South African War, and in any deductions drawn from enteric fever statistics in which the figures for 1900 and 1901 are included, the effect of the war on the returns must be taken into account. So far as Ambala is concerned, there is no doubt that the effect, considered as a whole, has been to lower the average sick-rate; the reduction it brought about in 1900 and 1901 not being counterbalanced by the increase in 1902 and 1903.

	Admission-rate per 1,000 of strength
1895-1899	39·3
1900-1904	33·4

The total war effect upon the average for the whole ten years was to reduce it to 36·3 per 1,000.

That the reduction in the enteric fever sick-rate in 1900 and 1901 was due to the war acting by means of the exceptionally weak British garrison here during those years, that is to say, to the absence of a large number of susceptible subjects, and not to improved sanitation, is, I think, sufficiently proved by two facts: (*a*) The rapid increase in the number of cases that occurred as soon as the British garrison returned to its normal strength; the old foci of infection by means of which the disease had been propagated

for years being, doubtless, reinforced by the introduction of fresh infection by men who were actually suffering from enteric fever, or who were convalescent from a recent attack of the disease in South Africa, and by Boer prisoners. (*b*) This fall in the sick-rate for enteric fever was general throughout India during the war years, as will be seen on looking at the chart on p. 255 of the Army Medical Department Report for 1904; consequently there must have been some general influence at work tending to reduce enteric fever, which affected Ambala in common with other stations.[1]

So far our examination of the enteric fever statistics of Ambala has been merely concerned with the local prevalence of the disease; in order to complete our review of the enteric fever history of this station, it is now necessary to show how Ambala compares with "all India" for the same period. As before, we shall first make a general survey, afterwards taking by sub-periods, so as to eliminate, as far as possible, the effect of the war on our figures.

On comparing the two records, it will at once be noticed that the admission and mortality ratios in enteric fever at Ambala have, on the whole, been far above those for "all India." Taking the averages for the whole ten years we find:—

	Admission ratio per 1,000 of strength	Mortality ratio per 1,000 of strength
Ambala	36·3	9·9
"All India"	22·5	5·4

There were, in fact, only three years—1896, 1898 and 1900—during which the disease incidence fell below the "all India" average, and during one year only—1900—was the death-rate per 1,000 of strength below the average death-rate in India.

Turning now to a comparison of the records by sub-periods, "all India" shows a steady rise in enteric fever incidence and mortality during the earlier years of the sub-period extending from 1895 to 1899, which reached its maximum in 1898; but in the fifth and last year the fall commences, which is such a marked feature of the "second" or "war" sub-period. The Ambala record, on the other hand, shows a fall in 1896 from the high level of the previous year, followed by tremendous rise in 1897, there having been no less than 138 cases and 33 deaths, equal to an admission ratio of 64 and a mortality ratio of 15·5 per 1,000 of the average annual strength. After 1897 the record shows a fall, beginning a year sooner than in the case of "all India," but continuing in a similar way throughout the two years 1900 and 1901 of the second sub-

[1] The chart has been omitted in order to save space.—EDITOR.

period; and just as the highest point was reached in 1897, one year before that of India as a whole, so our lowest point was reached one year before the "all India" averages showed the full effect of the war. In the third sub-period, the rebound after this artificial reduction can be seen in both records, but with the difference that, while in the case of "all India" there is only a moderate rise in the figures as regards the admission ratio, and but a trifling increase in the death ratio, the Ambala record shows an enormous increase in the admission ratio, and a well-marked rise in the mortality ratio throughout the whole of this last sub-period, 1902 to 1904.

B.—Period of Disease Reduction.

I have now, I trust, shown sufficiently fully the degree to which enteric fever prevailed amongst the British troops at Ambala during the years we have had under review, and so far the record has not been a very cheering or hopeful one. There remains, however, still one year's figures to examine, which are of a more encouraging character and give us hope of a brighter future. I have called 1905 the year of contrast, to distinguish it from the long series of years of prevalence, and the last four lines of the table given on p. 124 will show this difference.

It will be seen that in 1905 the British garrison was of average strength, and as regards composition there was nothing to distinguish the units from those of previous years, yet the reduction in the sick and mortality ratios is so great that one has to go back to 1889 to find a year during which the troops enjoyed so great an immunity from enteric fever; and out of the whole period extending from 1880 to 1904, there are only four years with equally low admission and mortality ratios. We find the admisson ratio of 36·3, and the mortality ratio of 9·9 per 1,000 of strength (average for the last ten years) have been reduced to ratios of 5·1 and 1·3 per 1,000 respectively. Not only is this far below anything known here for the period with which this table is concerned, but in the "all India" averages one has to go back for nearly the whole twenty-five years (to 1881) to find a year during which the admission- and death-rates stood at such low figures.

This concludes my examination into the enteric fever statistics of Ambala under headings A and B, by which the two following facts have been established: (1) For twenty-five years (1880 to 1904) the British garrison has never been quite free from enteric fever, and the combined figures for the past ten years give evidence of a formidable increase in both the admission- and death-rates

per mille; (2) during 1905 there was a most striking and unprecedented fall in both rates.

Without being blind to the danger of the *post hoc, propter hoc* fallacy, I attribute this immense reduction in disease to the introduction of the special sanitary measures to be presently described, for these reasons: (1) The diminution in the admission-rate is far too great to be due merely to epidemic variation dependent on obscure causes whereby we have "good" and "bad" fever years; (2) there was no difference, as I have already said, in the strength or composition of the garrison or any other exceptional circumstances to account for it. Further, there has been no relapse, as only one case of enteric fever has been admitted up to date (May, 1906). The disease in this case was clearly imported, and the patient recovered.

The continued absence of the disease favours the view that the reduction in 1905 was a genuine one, and brought about by sanitary reforms. I do not, of course, mean that our methods were absolutely original in themselves. Their value depends rather on the principle underlying them, which is embodied in the following articles of our sanitary faith: (1) To fight enteric fever with success at any station where it has been long endemic, it is necessary to employ sanitary measures of a more drastic and far-reaching character than has hitherto been considered necessary, or, at any rate, employed; (2) enteric fever being in several respects a more difficult disease to control than cholera, measures as thorough as those embodied in the anti-cholera regulations must be adopted if success is to follow.

The comparative failure to bring enteric fever under control that has been hitherto met with in India is, I believe, largely due to non-recognition of these facts.

C.—Causes of Enteric Fever at Ambala, and Factors concerned in its Propagation, together with the Sanitary Methods and Measures by which a Reduction in Disease Incidence has been Effected.

The various measures comprised in our present sanitary system were not, it will be understood, introduced in one day as parts of a complete scheme, but were gradually adopted as the sources of infection became manifest, and had often, indeed, to be modified or extended as practical experience suggested.

I shall first draw up a list of the chief known sources of enteric fever in India, and then show which of them have played the

most active part in the causation and spread of the disease at Ambala in the past, and lastly detail the special sanitary measures adopted to diminish or destroy their evil capabilities.

British troops in India are liable to contract enteric fever in the following ways; (1) By infection from specifically contaminated milk and water; (2 by infection derived from native bazaars; (3) by infection introduced from without by men joining or rejoining the garrison; (4) by infection drawn from locally existing foci (this includes latrine infection, camp and barrack infection, *i.e.*, localised and lingering infection of all kinds); (5) by infection from early and ambulant cases in barracks or camp; (6) by infection from mild and early cases in hospital prior to, or which escape, diagnosis; (7) by infection from convalescents from the disease after discharge from hospital; (8) by infection from ill-placed or badly managed trenching grounds.

Agents of propagation: *Wind, dust, flies.*

(1) *By Infection through Contaminated Water and Milk.*—The position of water at the head of the list is not to be taken as indicating the importance attached to it as a disease-bearing agent at this station; on the contrary, after impartial trial and examination, we have practically returned a verdict of "not guilty," and have dismissed both it and milk from the sanitary court of Ambala without a stain on their surfaces.

The characters of the epidemics that have occurred, at any rate of late years, negative the idea of water- or milk-borne disease, as, although there were generally a few sporadic cases scattered about cantonments, the outbreaks have been mainly localised in one set of lines, or in the camps of two closely adjacent battalions, while the married people and the families of officers have enjoyed marked immunity. As the whole of the garrison obtain their water and in a great measure their milk from the same sources, the epidemics would obviously have presented features of quite a different character had either water or milk been the agents of infection.

We do not on this account, however, neglect to take proper precautions to safeguard our water supply both at the source and during distribution, as the following will show: (*a*) The water for Ambala Cantonment is obtained from several deep wells situated some miles off. The well area is enclosed by high walls, so that chance of contamination at the source is practically impossible. (*b*) The water is pumped up and laid on everywhere by pipes, even to the standing camps, consequently contamination *en route* to consumers is highly improbable.

In addition, however, the following, to my mind somewhat exaggerated, precautions have also been taken to further ensure the purity of our water supply. In all the lines and camps water-boiling places are established near the standpipes. These places are enclosed by canvas screens as a protection against dust. Each unit is responsible for boiling its own drinking water. After boiling, the water is poured into galvanised iron receptacles (provided with taps and padlocked covers), after which it is further protected by "pinking" with potash permanganate.

No milk is supplied to the troops except from the Government Dairy Farm. It is sterilised before issue and sent out in locked cans.

(2) *Bazaar Infection.*—In spite of what is reported regarding bazaar infection from other stations, there is no evidence that enteric fever at Ambala has been derived from the native bazaars in the past to any great extent, although two cases were attributed to this cause last year.

When I was appointed District Sanitary Officer in November, 1904, I drew up a special enquiry form (appended) to ensure, so far as possible, systematic investigation of every case. The officer commanding station hospital had this form printed, and it has been in use ever since. At that time I thought that the bazaar frequenters might be found more often attacked by enteric fever than others. The answers received since then to Question 3 of the enquiry form have given no support to this idea, and as further evidence against the view that native bazaars are a common source of enteric fever, I quote the following from the Senior Medical Officer's report for 1904: "No doubt enteric fever is occasionally contracted by soldiers from the bazaars, but I do not think that this is a frequent cause. For instance, during the greater part of the past six months of this year (1904), all bazaars were placed 'out of bounds' for British troops on account of plague; it had no effect in mitigating the disease." He also adds "that there had only been one case of enteric fever in the Cantonment Hospital in two years," and, consequently, there is little probability that the specific germ can be widely distributed in the bazaars. So that, as far as Ambala is concerned, if a verdict of "not guilty" has not yet been returned against the bazaars, at least we consider them entitled to that Scotch compromise between guilt and innocence embodied in the verdict "not proven."

As we do not regard the bazaars as factors in causing enteric fever here, no particular sanitary measure has been introduced in respect to them.

(3) *By Imported Infection.*—This has been one of the most important causes of our epidemics in past years, and is, of course, the only cause of the appearance of enteric fever for the first time.

The annual exodus to the hills in April and return in October of a large part of the British garrison lays Ambala specially open to imported infection. In a report on an outbreak that occurred here in the autumn of 1904, I showed that the epidemic was undoubtedly due to imported infection. This had also been found to be the case as regards a previous epidemic in the spring.

There can be, I think, no reasonable doubt that this has been one of the great causes of the exceptional prevalence of enteric fever at Ambala; but there is another factor in the case of at least equal importance, viz., the insufficient barrack accommodation for the winter garrison, which necessitates our having two battalions of British infantry and two batteries of mountain artillery under canvas during the cold weather. The effect of tent life in spreading enteric fever will be considered in the next paragraph.

Imported Infection. Sanitary Counter-Measures.—As we regard imported infection as the most important of all factors in the causation of enteric fever outbreaks, a stringent system of quarantine has been introduced to safeguard the station as far as possible. All drafts and every individual non-commissioned officer and man coming or returning to Ambala are kept under observation for twenty-eight days in special camps. The isolation camps have their own conservancy arrangements, coffee shops, &c., and it is absolutely forbidden for any man under quarantine to enter any other latrine or intermix with the rest of the garrison. The men under observation are also visited daily by a medical officer, and every precaution taken to detect the disease in its earliest stage. Should a case of enteric fever occur, the quarantine time is sufficiently prolonged to ensure that the remainder have not contracted the disease. Such a large portion of the British garrison go to the hills for the summer and return for the cold weather that it is, unfortunately, impossible to protect the station completely against the chances of imported infection by extending this quarantine system to all the units of our winter garrison. This places us at a great disadvantage, and leaves a serious loophole for the entrance of disease.

(4) *By Infection from Locally Existing Foci, &c.*—It has long been known that enteric fever is liable to become established (or, as we say, "endemic") in certain localities; for this to be possible, however, it is necessary that the specific germ shall find conditions

favourable to its continued life and multiplication. Of recent years sanitarians in this country have become alive to the fact that in dry-earth latrines such conditions are liable to be existent. There is no direct evidence as to how far latrine infection has been responsible for the prevalence of enteric fever at Ambala in past years. It was, however, essential to guard against this danger, and, as I shall show presently, conservancy sanitation was made the basis of our system.

If it be doubtful what part defective conservancy methods have played in the spread of disease, there can be no reasonable doubt that the second most important factor in the exceptional prevalence of enteric fever here has been the favourable conditions provided by tent life for the persistence and spread of infection. The position of Ambala at the head of the list of enteric fever cantonments in 1903 and 1904 was due to the large number of admissions from battalions which, after spending the summer months at hill stations, returned to Ambala in the autumn, and were under canvas during the cold weather. The close personal contact of the inmates of tents, the impossibility of preventing fouling of the camp ground, especially at night, and the greater liability of contamination of food and drink by dust and flies, are so evident that there is no difficulty in understanding in what way camps become factors in spreading enteric fever. But it is evident that the infection becomes localised in some way in certain camping grounds, not necessarily in connection with the latrines; indeed, the elaborate sanitary precautions taken during 1904 to guard against this danger (when enteric fever was prevalent in the standing camps) seems to me to put latrine infection entirely out of court. These and all other measures, such as disinfection, segregation of contacts, &c., failed to check the outbreaks, which, nevertheless, stopped like magic when the affected battalions were moved to fresh camping grounds.

This has opened our eyes to the necessity of early change of camping grounds when enteric fever makes its appearance. In future this step will, I have no doubt, be taken much earlier than has hitherto been considered necessary. As, however, our system of standing camps rendered us specially liable to the introduction and spread of enteric fever, the following protective measures were introduced in 1904, and have now been officially recognised in this country :—

Instructions in Case of Enteric Fever Appearing in Standing Camps.—Whenever a man is admitted to hospital for enteric fever, or with a suspicious pyrexia, the officer commanding is to be at

once informed. The tent must be disinfected and then struck, the ground on which it stood being afterwards freely treated with lime. The contacts are to be isolated for fourteen days under medical supervision, being provided with separate latrines and urinals, and all their excreta sterilised by boiling, just as if they were actual cases of enteric fever; the bedding and kit of the man attacked, and of all contacts, being sent to the station hospital for disinfection. In the process of disinfection of the camp special attention was ordered to be paid to the latrines and urinals. I need not go into details concerning the process as they are now officially laid down; suffice it to say that disinfection is thoroughly carried out, the woodwork, receptacles, troughs of the latrines and urinals, as well as the ground on which they stand, being cleansed and sterilised. That the *Bacillus typhosus* can still survive appears to me quite incredible.

Localisation of Infection in Barracks.—An attempt is being made here to investigate the question as to the localisation of infection in barrack-rooms in the following way: Plans drawn to scale have been prepared for all lines occupied by British troops, on which each bungalow is depicted. Whenever a case of enteric fever is admitted the date is entered on the plans against the number of the bungalow the man had occupied. All cases of the disease admitted during the last four years have also been recorded in like fashion, as on accompanying plan.

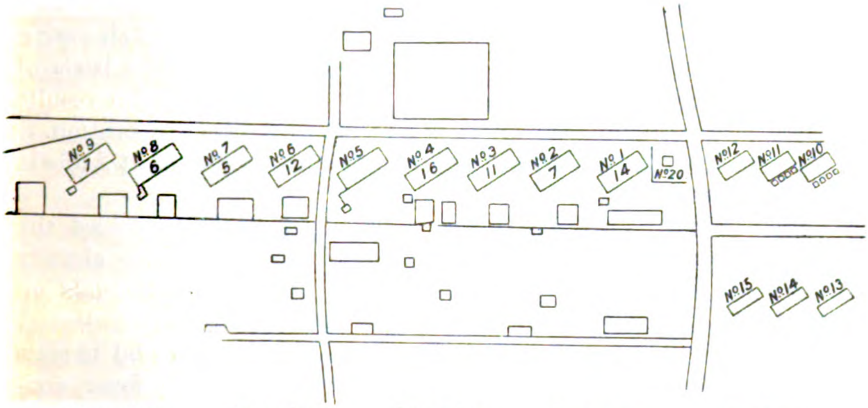
The results so far obtained are decidedly interesting and give some support to the view that the infection may become localised in the barrack-rooms themselves as well as in the latrines. For example, from barrack-room No. 1 on the plan four cases were admitted in 1902 on the following dates: November 13th, 15th, 17th and 25th, suggesting infection from a common source. The same thing occurred in the following April, and in 1905 a case was admitted on August 25th, followed by two more on September 1st. From bungalow No. 2 five cases were admitted in 1903, four of them within one week of the same month. Bungalow No. 4 shows again a remarkable succession of cases in May and June, 1903.

Precautions against the Spread of Enteric Fever in Barracks.—The precautions already mentioned for camps are also, *mutatis mutandis*, taken whenever an occupant of a barrack bungalow is admitted either for a definite attack of enteric fever or with symptoms of a suspicious character; and the room is vacated for fourteen days after disinfection.

Let me here call special attention to the fact that we do not wait for an exact diagnosis before taking precautions against the spread of contagion. To my mind, this is a detail of great im-

PLAN OF THE BARRACK BUNGALOWS IN THE BRITISH CAVALRY LINES, AMBALA.

With the dates of admission of the enteric fever cases from among the occupants of each since 1902, and with the total numbers for the last four years marked upon the bungalow.



Bungalow No. 1.	*Bungalow No. 2.*	*Bungalow No. 3.*	*Bungalow No. 4.*	*Bungalow No. 6.*
13.11.02	14.11.02	14.11.02	12.11.02	29.10.02
15.11.02	26.12.02	20.11.02	20.11.02	13.11.02
17.11.02	3. 1.03	24.12.02	21.11.02	18.11.02
25.11.02	7. 5.03	29.12.02	20.12.02	20.11.12
12. 1.03	10. 5.03	16. 1.03	23.12.02	31.12.02
24. 1.03	12. 5.03	16. 3.03	15. 5.03	19. 1.03
1. 4.03	15. 5.03	25. 4.03	16. 5.03	2. 2.03
18. 4.03		1. 5.03	13. 6.03	10. 4.03
19. 4.03		10. 5.03	17. 6.03	5. 5.03
20. 4.03		25.12.03	18. 6.03	17. 5.03
27. 4.04		2. 1.04	19. 6.03	1. 4.04
25. 8.05			25. 6.03	2. 5.04
1. 9.05			26. 6.03	
1. 9.05			23. 7.06	
			25. 7.03	
			8. 8.05	

Bungalow No. 7.	*Bungalow No. 8.*	*Bungalow No. 9.*	*Band Room.*
24.12.02	25. 3.03	25. 3.03	8. 6.03
13. 5.03	27. 3.03	8. 4.03	30.10.03
27. 3.04	13. 2.04	21. 4.03	7. 4.03
10. 5.05	16. 2.04	7. 4.04	
6. 6.05	1. 5.04	15. 4.04	
	10. 5.04	23. 6.04	
		5. 2.05	

portance and one that must be strictly adhered to if the disease is to be stamped out.

Localisation of Infection in Latrines.—Among possible internal

centres of infection, none are so common and dangerous as insufficiently supervised dry-earth latrines infected by early or ambulant cases. The great liability that exists that enteric fever will become localised in these places unless a very thorough system of conservancy sanitation be enforced is now generally recognised. That latrine infection was at the bottom of the endemic persistence of enteric fever at Ambala we have good reason to believe, and this was one of the first things that Lieutenant-Colonel Woodhouse directed his attention to when he took up the task of stamping out enteric fever. As our conservancy methods form the basis of our system of sanitation, and as I attribute the successful results chiefly to them, I must devote a little time to their consideration.

The counter-agents against latrine infection employed at Ambala are of two kinds: (1) Indirect; (2) direct.

Indirect Measures of Latrine Sanitation.—I have placed the indirect measures first as two of them are among those already detailed, viz.: (1) The quarantining of drafts and individuals on arrival; (2) the isolation of contacts, even for a case of suspicious pyrexia, and the thorough disinfection of the latrines and urinals of the unit concerned; (3) the segregation of enteric fever convalescents, for whom special latrines and urinals are provided; all their excreta being sterilised before removal to the trenches.

It is obvious that these measures must have a real, thorough, indirect effect, in preventing the possibility or minimising the risk of latrine infection. In addition to these we have a regular sanitary organisation to ensure that the direct measures I am about to mention are efficiently carried out.

Direct Measures of Latrine Sanitation.—(1) The sanitary cadre; (2) the company or squadron latrine and urinal system.

About a year ago Lieutenant-Colonel Woodhouse inaugurated a reform in the old and, so far as I know, except at Ambala, the still existing system of regimental sanitation. By the new Ambala system the sanitation of a regiment, battalion, or other unit, is no longer centralised in the quartermaster's office, the Senior Medical Officer holding that the sanitation of a regiment is a matter of too great importance to be controlled from any but the commanding officer's office; the commanding officer acting, of course, through officers commanding companies so far as company sanitation goes. The only sanitary control left to the quartermaster is that of the married quarters. The medical officers in charge of units are directed, therefore, to deal directly with the commanding officer as regards sanitary matters, and not with the quartermaster.

There are several objections to having the regimental sanitation in the hands of the quartermaster, but it is beside my purpose to go into this subject now.

From each company, squadron, or battery, a corporal or bombardier and one private are selected to form the regimental sanitary cadre. These men are struck "off duty," and are first put through a course of instruction as to their new duties. The instruction is given partly by lectures and partly by practical demonstration. Each party is responsible for the sanitation of its own company latrines and urinals, for the supervision of the native sweepers, and the carrying out of the instructions regarding the sanitary details of latrine management, which I shall refer to presently.

One of the most important counter-measures against the spread of enteric fever by latrine agency is, to my mind, the institution of a strictly company latrine and urinal system. This method is adopted here in barracks, and after the autumn epidemic in 1904, the same system was introduced into the standing camps. It is obvious what a beneficial influence this system will have if strictly adhered to in limiting the spread of such a disease as enteric fever. On the other hand, supposing a man of a company, while in the incubation stage of enteric fever, uses the latrines and urinals of his unit indifferently, the whole unit becomes exposed to the chance of infection, instead of merely the men of one company.

Sanitary Detail of Latrine and Unit Management. — The sanitary cadre are directly responsible to the medical officer in charge of the unit for the carrying out of the following sanitary details in connection with the latrines and urinals of their unit: The urinal troughs are not to be tarred; they must, however, be kept quite clean, and no deposit of urates or other salts permitted. To ensure this, the interior is rubbed over daily with kerosene oil. This, of course, prevents any deposit of urinary solids and also renders the trough unattractive to flies, on account of the strong odour, and cleanliness of the surface. *Latrines:* A double set of "gumlahs" is provided, so that the same pan shall not be in use on two consecutive days. On the off day the "gumlahs," after being well cleaned out with kerosene oil and crude carbolic acid, are left exposed to the air, the open end being placed uppermost. The wooden seats are washed and then both surfaces are brushed with kerosene oil. Here, again, the chances of contagion becoming localised are reduced, and flies are no longer attracted, and consequently a blow is aimed at two sub-agents of infection at the same time. Great importance is attached to keeping the soil inside the

latrine enclosure firm and clean. To effect this the ground is watered with kerosene oil every day for one week; after that the oil is applied twice a week; by this means a firm, dust-free surface is obtained, thus depriving the wind of a chance of carrying contaminated dust on to the food, or directly into the bodies of the men. It should be added that no brushing of the ground is allowed; any soiled patches found must be scraped away and removed, kerosene being afterwards applied; pieces of paper, &c., being removed by hand.

The men of the sanitary cadre are held responsible for carrying out these details of sanitation, as well as for the general sanitation of the barrack surroundings.

I now come to the last detail of our anti-enteric fever conservancy sanitation. Lieutenant-Colonel Woodhouse has introduced a system of day, in place of night, removal of the soil to the trenching grounds. There is no need to dilate on the sanitary drawbacks of the night removal system, but that enteric fever has often found in it a useful "ally" there can be little doubt. The sewage polluted ground must only too often have afforded the *B. typhosus* a culture medium favourable to its continued existence, and dust, wind and flies have seldom been wanting to act as most efficient conveyers of the specific germ to the unfortunate British soldier. The objections to day removal are chiefly of a sentimental character, which cannot be allowed to out-weigh the practical advantage of doing such work in the daylight, when proper supervision can be exercised. The absence of flies at night is urged in favour of night removal, but as the chances of fouling the ground are so much greater at night and flies appear at daybreak, the advantage is illusory.

This concludes my account of the reformed conservancy sanitation introduced by Lieutenant-Colonel Woodhouse at Ambala. I have still to describe the sanitary measures by which we seek to close the other avenues and sources of infection enumerated under paragraphs 5, 6, 7 and 8. I have, however, spent so much time over the more important causes of enteric fever at Ambala that I must content myself with dealing very briefly with the relatively less important ones.

(5) *Infection from Early and Ambulant Cases.*—From the nature of the agency, no direct counter-measure can be introduced, but our method of quarantining drafts on their arrival, and especially the segregation of contacts for fourteen days, under daily observation, are efficient, though indirect, counter-measures; again, the isolation of all contacts (even in cases of suspicious pyrexia) aids

in the detection of the disease at its earliest stage, and therefore counteracts to some extent the danger of further spread.

(6) *Infection from Mild and Early Cases in Hospital Prior to, or which Escape, Diagnosis.*—I have already pointed out that we do not wait for a diagnosis, but take all precautions whenever a case of suspicious pyrexia is admitted. This is one safeguard against the spread of infection by early cases. In addition, the whole of the excreta of patients in the Station Hospital, Ambala, is sterilised by means of the portable army excreta steriliser, described by me in a previous number of the Journal, which effectually shuts off this source of infection.

(7) *By Infection from Convalescents after Discharge from Hospital.*—One of the earliest measures as regards anti-enteric fever sanitation, which was introduced here by the present Senior Medical Officer, was directed against the spread of the disease by convalescents discharged from hospital. A regulation was brought in by which all patients, after recovery from an attack of enteric fever, had to be segregated for two months, under medical observation. They are, of course, provided with a special conservancy, and are not allowed to use any latrines but those provided for them, and sterilisation of all sewage is compulsory. At first, each unit had a segregation camp for its own convalescents; for the last year, however, the system has been improved by the establishment of a central segregation camp for men of all units, and having its own special staff. All excreta are sterilised by means of the portable army excreta steriliser, mentioned in connection with the Station Hospital. The convalescents are treated with urotropine while undergoing this quarantine, or some other urinary antiseptic, and every precaution is taken to prevent the contamination of the camp soil.

(8) *By Infection from Ill-placed and Badly Managed Trenching Grounds.*—Although there is undoubted evidence that ill-placed and badly managed trenching grounds have caused enteric fever epidemics at other stations, I do not think this agent played any part in the late outbreak here, in spite of the fact that the cantonment filth trenches were, up to nearly the end of 1904, so ill situated that they very rightly fell under suspicion. At any rate, the change of site produced no apparent effect on the considerable prevalence.

With regard to the existing three great propagators of enteric fever—wind, dust and flies—I shall say little, having already indicated what the sanitary weapons are we employ against them. To attempt to attack these vehicles of infection more directly would

be an error in tactics, indeed, as regards the first-named, an impossibility. No flies are tolerated in or about our latrines, urinals or cookhouses, their mere presence being regarded as proof that the standing orders for the sanitary care of these places have been neglected. Our conservancy regulations, properly carried out, effectually deprive these potential "allies" of enteric fever of their capacity for evil, or render them non-existent.

Conclusion.—Although the number at the top of this page admonishes me that it is advisable to make this the concluding paragraph of my paper, I cannot, I fear, claim to have dealt in any way fully with my subject. Often, indeed, I have only been able to give an outline where I had intended to paint a complete picture. Concerning our sanitary regulations for cookhouses, the protection of food, &c., the excessive number of cookhouses, which is such a feature of military cantonments is, to my mind, an economical as well as a sanitary error. Many other sanitary details I have not been able to enter upon at all.

REPORT ON CASE OF ENTERIC FEVER.

Date of Admission................

Name. Company (or Squadron). Regiment. Age. Service { *Total* / *Indian* }

To be answered by the Commanding Officer:

1.—Has the above-named man been absent from Ambala during the last three months? If so, where has he been? On what date did he return?

2.—Was he noticed by his comrades to be ailing for any length of time before reporting sick?

3.—What were his habits? Has he been known to frequent any particular drinking saloon in the Bazaar? If so, please give the address.

To be answered by the medical officer in charge of unit. If there is not sufficient space to answer any particular question, the reply should be written on a separate sheet, and attached to this form.

4.—Have the regulations regarding the sterilisation of the drinking water, contained in the Senior Medical Officer's Sanitary Circular, been strictly complied with?

5.—What is the source of the milk supply; especially as regards that used in the coffee bar?

6.—From whom are the mineral waters on sale in the canteen and coffee bar obtained? What system of supervision is there as regards their manufacture?

7.—What are the precautions, if any, exercised to prevent the sale of liquor in the lines by natives?

8.—Are the latrines and urinals in good order? Have the instructions regarding them, and the method of disposal of sewage, contained in the Senior Medical Officer's Sanitary Circular, and Sanitary Letter 3033, been strictly complied with?

9.—Have you had to report unfavourably on the sanitary condition of the lines of this unit during the past month? If so, in what particular?

10.—What are the arrangements in force in this unit to ensure the segregation of (1) drafts on arrival, (2) typhoid convalescents.

11.—Can you suggest any possible source of infection in this case?

12.—Has the diagnosis been confirmed bacteriologically? Has the man ever undergone anti-typhoid inoculation? If so, give date.

Date...........190.. *Medical Officer in charge.*

(To be completed with as little delay as possible, and returned to the Special Sanitary Officer, Ambala.)

THE TEETH OF THE SOLDIER.

By Lieutenant-Colonel S. WESTCOTT, C.M.G.
Royal Army Medical Corps.

Prevalence of Decay.—Caries of the teeth causes the loss to the Service of a large number of men, some of them refused by the recruiting agencies, and others invalided after varying periods of service. The recruiting returns do not show the number lost to the Service by the rejections at the recruiting offices: they simply indicate the number of those offering for enlistment who suffer from caries to such an extent that they are considered unfit for the Service; their teeth are examined, and if they are unfit, no further time is wasted in hunting for other disqualifying defects. In order to get some idea of the real proportion of men who were lost for defective teeth alone, I obtained from the five largest recruiting centres returns for the month of March, 1906, of those whose only defect was caries of teeth. A comparison of these returns with those for the previous month furnishes a rough idea of the proportion of men rejected for teeth who were also unfit for other reasons.

	I. February, 1906	II. March, 1906
Manchester	29	13
Leeds	29	10
Liverpool	23	9
Sheffield	17	6
Preston	19	5
Average	23·4	8·6

I. Those rejected for teeth; other defects not being looked for.

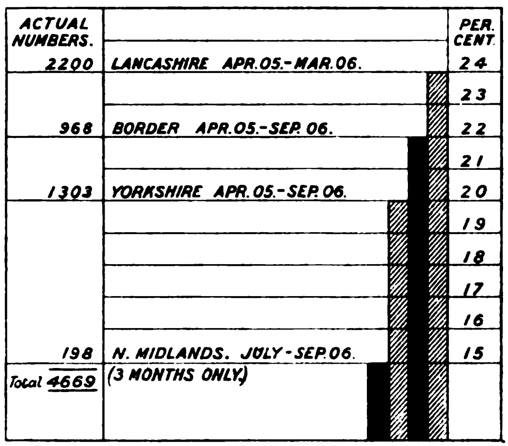
II. Those who, after complete examination, were found to be disqualified by reason of bad teeth only.

It will be seen that a large proportion of those usually shown as rejected for "teeth" possess other disqualifying defects, in this instance about two-thirds. The following Charts, A and B, show the actual numbers of men rejected for "teeth" in the Northern Command during the period April, 1905—September, 1906, and the percentage of those offering for enlistment, arranged for purposes of comparison in "grouped districts" and towns.

Function of the Teeth.—The main value of the teeth is their function of dividing food in order that it may be mixed with the saliva and easily swallowed in a convenient form for gastric digestion; only a very small percentage of the starch of the

food is changed by the time it leaves the stomach, and it would appear that ptyalin, the only ferment in saliva, is of very little importance for the digestion of starchy foods, which occurs chiefly in the duodenum by means of the amylopsin of the pancreatic juice. Saliva is practically water (99·42 per cent.), and its principal function is to dissolve certain constituents of food. These facts explain how the toothless man is able to maintain his health, for, provided he takes his food in a sufficiently divided condition and mixes it well with saliva before swallowing it, digestion will proceed as perfectly as in the man with a good set of teeth. The nutrition of the toothless man therefore depends on the character of the food which he is able to obtain; he cannot

CHART A.

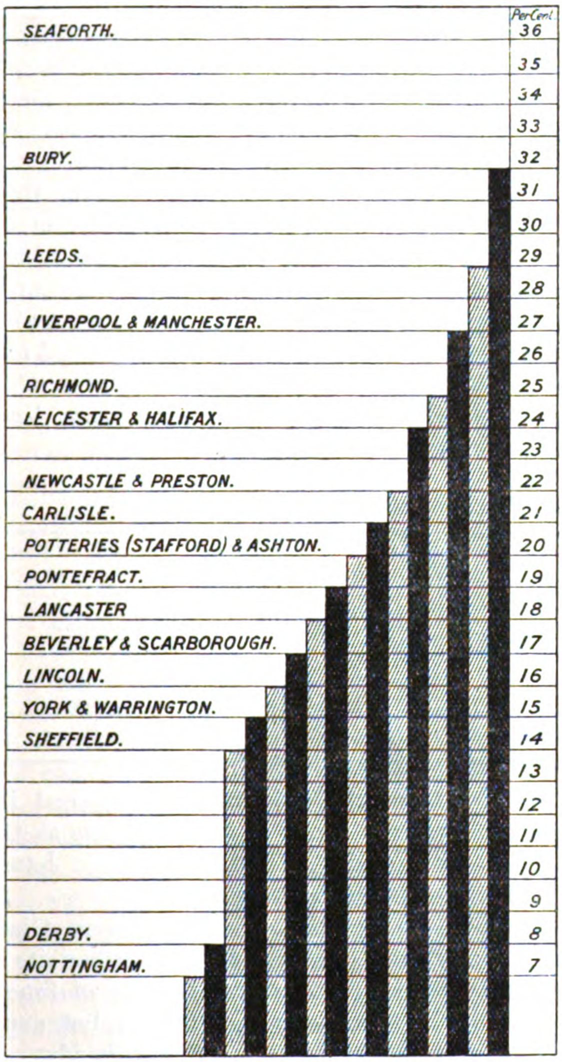


eat tough meat or uncooked vegetables, but he can obtain his carbo-hydrates from such foods as potatoes and bread, his nitrogen from eggs and milk, and his salts from Bovril and soup, and, provided that he does not neglect the churning with saliva in the mouth, in many instances gets on as well without teeth as with them.

Causes of Decay.—Caries is a chemico-parasitical process consisting of two distinctly-marked stages; decalcification of the tooth, and solution, or peptonising, of the soft residue. In the case of enamel there is no soft tissue to be dissolved. The acids, particularly lactic acid, by which the process of decalcification is produced, are mainly derived from the fermentation of carbo-hydrates.

The starch is transformed by the ptyalin of the saliva into grape-sugar, which, by the action of various species of bacteria, is converted into lactic acid. Many bacteria found in the mouth are

CHART B.



capable of effecting the whole change from starch to lactic acid. When the lime salts have been dissolved by these means, organisms invade the dentine tubules, and, by a digestive or peptonising

action, dissolve the soft tissues. Many species of bacilli and cocci found in the mouth are capable of producing this change. There is no specific germ of caries; sometimes one, at other times another species is found. Predisposing causes are—defective formation of the teeth, a deficiency of lime salts, the presence of pits and crevices which encourage the lodgment of carbohydrate food, acid food and drinks, such as cyder and uncooked fruit, civilisation, and neglect of the tooth-brush. Caries is an effect of external causes, and may occur in the well-developed teeth of men of perfect physique and health. The liability decreases with age, and its commencement is less frequent after the age of 25.

It is interesting to note, in connection with the theory so commonly held, that caries is caused by a deficiency of lime salts in water supply, that Sheffield with a low water hardness is nearly at the bottom of the comparative caries table (III.), and Leeds and Halifax, with a high caries index, have also high degrees of hardness in their water supplies. The lime salts required for the formation of bone and dentine are principally derived from foods such as milk, butter, cheese and bread; water supply has little influence either during development or afterwards.

TABLE III.—TABLE SHOWING RELATION OF LIME SALTS TO CARIES.

	Water Hardness			Percentage rejections for teeth
	Total	Fixed	Removable	
Leeds	7·78	3·50	4·28	29
Halifax	8·8	3·96	4·84	24
Sheffield	5·5	4·5	1	14

The Inter-Departmental Committee on Physical Deterioration made this point clear as a result of their enquiry at Glasgow, and concerning which I furnish an extract from a letter from the Medical Officer of Health, Glasgow :—

"As a factor in the production of rickets in Glasgow, water may, I think, be neglected. It was foretold, when its introduction was proposed fifty years ago, that the absence of lime salts would powerfully influence the prevalence of rickets, but experience has, I think, shown the erroneous character of this idea. Within the period of the present water supply there has been an undoubted prevalence of rickets, up till the early eighties, probably, and also a considerable decrease, without any change whatever in the water,

but with a considerable change in the sanitary surroundings of many portions of the population. As this matter is referred to in my evidence before the Inter-Departmental Committee on Physical Deterioration, will you allow me to append some extracts. I agree with you that improper feeding is among the most potent causes of rickets."

The subject of decayed teeth cannot be dissociated from the bacteriology of the mouth. The mouth is crowded with micro-organisms; the more diseased it is, the greater the numbers and varieties, some pathogenic, others not. Of these organisms a large number cause the fermentation of grape-sugar into lactic acid, a large number also have a peptonising action, and render soluble albumen, gelatine, &c. There are several forms of micro-organisms which are found in every mouth, the commonest are: the mouth Diplococcus of Van Lingelsheim, *Bacillus buccalis maximus, B. fusiformis, B. lactis, Indococcus vaginatis, Leptothrix innominata, L. buccalis maxima, Spirillum sputigenum*, and the *Spirochæta dentium.*

Properties of the Various Organisms.—Leptothrix is associated with the formation of tartar, and is the chief constituent of the cheesy nodules common in the lacunæ of the tonsils of young people of impaired constitution. Spirochæta in association with *B. fusiformis* is one of the most frequent causes of caries. The mouth Diplococcus of Van Lingelsheim is present in all mouths, attached to, or in the interior of, epithelial cells. It is non-pathogenic, and is able to ferment urea to ammonium carbonate in the presence of peptone. Sarcinæ and bacilli of the mesentericus group are constantly found in healthy mouths, and also the *Diplococcus pneumoniæ, B. diphtheriæ*, the Diplococcus of rheumatic fever and the tubercle bacillus—the tubercular cervical glands so commonly found among the children of the poor are caused by the absorption of bacilli through the tonsils. The bacilli of the various forms of common colds, *B. catarrhalis, B. coryzæ* and *B. segmentosa*, are also frequent visitors to the mouth. Many of the organisms found in the mouth are very virulent, those connected with *Pyorrhœa alveolaris* are considered to be especially so. Goadby, in 1904, inoculated twenty-four rabbits or guinea-pigs with septic material from the mouth, or cultivations from it. Half the number died with symptoms of septicæmia in periods varying from eighteen hours to six weeks, and in each instance an organism was recovered from the heart blood. Now, what is the significance of the presence of these multitudes of germs? The mouth is a perfect incubator,

kept at the correct temperature, and as a rule well supplied with cultivation pabulum and moisture, so that one would imagine that enough septic material was manufactured to kill anyone in a short space of time. We have seen that guinea-pigs and rabbits die from the effects of inoculation with oral septic matter, but we do not observe these effects in the human being; the mucous membrane of the mouth must therefore be most resistant, even in the diseased condition which exists, as a rule, in a septic mouth, and the germs and their toxins cannot find their way into the general circulation in this way. The tonsils are, however, the frequent site of bacterial invasion, and the portals for systemic infection. But apart from the danger of organised attacks, there does not seem to be a general and constant absorption of toxins into the circulation from the mouth.

Ingestion of Bacteria and their Ferments.—The next point for consideration is the disposal of septic material after it is swallowed; again, there is no probability that it is absorbed under normal conditions of health—the great majority of the organisms are digested in the stomach. When there is a normal amount of acid present no growth occurs, but spores and certain resistant species pass on to the duodenum. If the secretion of the stomach is not normally acid, organisms usually digested multiply and pass on to the intestine. The contents of the duodenum are alkaline, and the germs which normally arrive there with the chyme multiply with great rapidity, and assist the pancreatic ferments in the digestive processes which they are capable alone of carrying to a further degree, both in the starches and proteids. There is no doubt, also, that these useful, healthy germs digest the lower, more poisonous and pathogenic ones; they are capable even of splitting up their ferments, and so of nullifying the effects of oral sepsis or the accidental ingestion of disease germs.

It is an established fact that bacillary toxins may be absorbed from the digestive track, and that, in consequence, tolerance of poisonous doses is established. According to Pliny, King Mithridates was well acquainted with this method of immunisation; he did not inoculate under the skin the poisons against which he immunised himself, but introduced them into the stomach. Behring has used this method successfully in the tuberculosis of sheep and other animals. Koch, also, has habituated human beings to tuberculin, and Ehrlich has experimentally used the poisons of poisonous plants in the same manner.

Persons suffering from diseased teeth continue swallowing an

emulsion of pus and germs with their ferments for practically the whole of their lives, and as a general rule without any consequent ill effect on their health; I also remark that Goadby records a strong reaction to the inoculation of immunising doses of streptococcic emulsion for the treatment of pyorrhœa, showing that no tolerance for the strain used had been established by the swallowing or absorption of the infective material from the alveoli. I therefore surmise that the small doses of ferments constantly swallowed are split up, probably chemically, in the stomach, and rendered harmless before absorption takes place. I do not think that oral sepsis predisposes to specific diseases of bacterial origin. The presence of such an enormous number of different species of organisms, many of them very hardy and prolific, all fighting against each other for existence, results in the survival of the strongest, amongst which the pathogenic germs are not accounted; the acid reaction, also, of a diseased mouth is inimical to the growth of most pathogenic germs.

Physical Degeneration and Decayed Teeth.—Bad teeth do not cause poor physique and impaired constitution; their quality depends on nutrition during the period of their development, and it suffers in like proportion to the other structures of the body. I have frequently sought to select the toothless and orally septic from among the weeds of the recruiting rooms and the Militia at the depôts by their appearance and complexion, and have been surprised at my failure; I more frequently find a good set of teeth than otherwise in the cachectic. The converse holds good, the man of finest physique often possesses a very diseased set of teeth.

Effects of Toothlessness on Military Service.—Opinions, both in the Army and among the public, including those of the medical and dental professions, as to the desirability of enlisting toothless men for the Army vary to an extreme degree; some would accept a man of fine physique and good health without even looking at his teeth, others demand a perfect denture. In order to study the effect of toothlessness on the durability of a soldier I examined 400 men of from seven to twenty years service serving in the Northern Command. They had all served abroad and a large proportion had seen active service; 18 per cent. had not a single opposing pair of molars or bicuspids, 2·25 per cent., in addition, had only single molars opposing, or two pairs of bicuspids; most of the molarless, however, possessed some sound front teeth. Nine men possessed plates; seven of these wore them and liked them, but stated that they could get on very well without them, and, with one

exception, regarded them as a luxury. One man, whose only entry on the medical history sheet was for "Caries of Dentine," came home from a colony and was provided with artificial teeth at the public expense; he accepted the teeth but never wears them, as he finds that he gets on very well without them. Another man on being medically examined for extension of service was discovered to be toothless, and was provided with a denture; he accepted it as a means to an end, but has never worn it, as he did not feel the necessity. I was greatly astonished at the absence of evidence of evil influence of this state of toothlessness on the general health and utility of these men. In a general sense they were of healthy and robust appearance; most of them had either no entries on their medical history sheets or they were for trivial complaints only, in no way connected with malnutrition or with digestive defects. According to their statements their teeth had disappeared without making any impression upon their minds or their habits, and, with one exception, without toothache or neuralgia. They masticated their food somehow, the majority could not explain how, but a certain proportion said they used their front teeth and found them efficient. I gather from this enquiry that front teeth are of value for masticating purposes, and that stumps, even diseased ones, are efficient. They provide a broad surface for mixing, even if they are unable to cut and break food. It is evident, therefore, that when judging of the "possession of sufficient sound teeth for purposes of mastication" in a man of fine physique, that due value should be apportioned to the front ones, and to stumps.

The possession of decayed teeth may be regarded as universal among the rank and file of the Army, some have many, others few, and the little trouble they occasion is remarkable; toothache and neuralgia are rare, and when they occur, are treated by extraction of the offending tooth, and no more is thought of the matter. During my whole service I have never been impressed by the existence of a tooth question (except during the South African war), nor can I find any evidence of its existence, with this exception. In the Army Medical Reports it is not even mentioned, so that dental caries cannot be a cause directly of much sickness or invaliding.

The importance which has been attached to this subject of late years is apparently due to the experiences of the South African war, during which a considerable number were admitted to the hospitals and invalided home for caries of dentine.

The following table (IV.) will convey a general idea of the extent of the losses for this cause after the war.

TABLE IV.—ADMISSIONS AND INVALIDS FOR CARIES OF DENTINE.
South Africa.

	1902	Per 1,000	1903	Per 1,000	1887
Strength	50,125	..	27,680	..	7,205
Admissions ..	627	12	322	11	0
Invalids	225	4·5	79	2·7	0

The South African war caries has no connection with that of the ordinary decay of peace time, nor with the standard of teeth which should be required of recruits; it is rather a question of the preventive hygiene of war, and must be classed with enteric, dysentery and scurvy as a disease of long and trying campaigns. It was due to the attack of organisms of extreme peptonising and acid-forming powers on the alveoli, gums and teeth of those rendered susceptible by exposure to the reducing influences of long-continued active service. It was of the nature of an epidemic, and prevailed to a greater extent than is suggested by the returns. It was simply an outcry from exhausted Nature for a period of recuperative rest, and it will happen in any country under similar circumstances, and can be prevented by obvious means.

The conclusions to be drawn from this enquiry are that much greater consideration should be given to the physique and constitution of a recruit when judging the teeth, and that it is safe to accept men of exceptional physique with a very low standard, in which the possible value of stumps should be considered, many being quite durable or capable of being made so.

Any plan of circulating diagrams as guides to the interpretation of the regulations, which demand a sufficient number of sound teeth for purposes of mastication, is unsatisfactory; it tends to warp the judgment and narrow the outlook of the physical examiners. Although it may be affirmed that standards are not to be construed literally, but merely as guides, any difference of opinion between inspecting and executive officers leads to a hasty retirement to the defence of the rigid observance of diagram standards, and the loss of good men. It is, I think, much better to discuss with all concerned the observance of a common-sense standard on the lines I have indicated, and in the spirit of the excellent Medical Regulations.

The employment of local dentists in this Command since June, 1905, has been a success. The object the General Officer Commanding-in-Chief had in view was the saving for the Service by

dental treatment of men who would otherwise have been rejected. An order was given to all recruiting medical officers to the effect that no recruit was to be rejected for defective teeth who could be rendered efficient by dental treatment at a reasonable cost, the services of the Command Dental Surgeon being used if the railway fare to him cost less than the fee for local treatment. Registered dentists of good standing accept fees in most of the large towns of 2s. 6d. per stopping and 1s. per extraction, gas 2s. and 2s. 6d. extra, or contract for the sum of 10s. per recruit, taking the bad with the better. The system provides for the inspection of all dental work by the medical officer before he signs the final approval on the medical history sheet. Dentists are requested not to attempt any work which they cannot, according to their judgment, guarantee to last. As far as I am able to judge, this condition is being observed, but time only will divulge the quality of the work done. The refusal of treatment by recruits was, in the early days, somewhat frequent, but it is now quite exceptional. During the period June, 1905, to September, 1906, 1,510 recruits were treated at a cost of £588 8s., an average of those offering for enlistment of 7 per cent., at a cost of 7s. 9d. each.

Decay of teeth is practically a universal complaint, and the difference between one person and another is simply one of degree. Owing to this universal prevalence, it is impossible to estimate correctly its influence on health, but we know that people live long and healthy lives in spite of it. It is difficult to appraise the financial value of any particular sanitary preventive measure, but, on principle, it may be regarded as certain that a person possessing good teeth and a healthy mouth is a better "life" than one suffering from oral sepsis; it would not be just, however, to spend public money on the teeth of any particular class, and therefore the expenditure on recruits should be regulated by the state of the recruit market, and incurred only when an excursion into the toothless section is required to complete numbers. I estimate that 10 per cent. of good men can be added to the strength of the Army by the aid of local dentistry. It would be better to select any smaller proportion from all sources, than to press the system in any single Command. The financial return to be expected from this system is largely dependent on the systematic use of the tooth-brush, which should be insisted on in all branches of the Army.

SOME NOTES ON SURGICAL TECHNIQUE.

By Captain F. E. GUNTER.
Royal Army Medical Corps.

For some time past I have been making notes as to the result of operations I have done at the Curragh from the point of view of asepsis, and I think a description of the methods used, and their success or otherwise, may be of some general interest, though I have little new to bring to light.

Preparation of the Operation Area.—This I always do myself the night before performing the operation. Thus one has only oneself to blame if it be not done properly. Having washed my hands thoroughly, I put on rubber gloves. This may seem an unnecessary precaution, but one has probably infected one's hands in some outdoor pursuit during the afternoon. It is certainly a cleanly practice from the operator's point of view. The operation area having been shaved is thoroughly scrubbed with ordinary soap and water and a nail brush, and then rubbed with a sterilised towel. After this, methylated spirit is well rubbed in (at one time I used turpentine, as recommended by Messrs. Cheyne and Burghard, but this ruins the gloves). After the methylated spirit, Cheyne and Burghard's "strong mixture" (corrosive sublimate 1—500, carbolic 1—20) is thoroughly applied, and finally a poultice of 1—1,000 corrosive is applied for the night. When the patient is under the anæsthetic, I give a scrubbing down with ether soap, methylated spirit, and 1 in 1,000 corrosive sublimate.

Preparation of the Hands.—I wash my hands very thoroughly with soap and water and a nail brush, and polish the nails most carefully. Haegler lays the greatest stress on this washing, which, he says, is by far the most important item in the disinfection of the hands. He recommends that in order to learn the capacity of one's hands for taking up dirt, one should smear them well with Indian ink and let it dry, and then scrub the ink off with soap and water. I have tried this, and certainly find that it is much more difficult to remove all traces of ink than one would imagine. After washing the hands with soap and water, Haegler recommends that they should be dried thoroughly by rubbing with a rough towel, as this helps to remove the *débris* of epithelium. He tested his hands by rubbing them with a sterilised thread, with which he afterwards inoculated gelatine plates, before and after

rubbing with a towel. The thread cultures from the rubbed hand showed many fewer colonies than from the unrubbed hand. I tested my hands by means of this thread test, and obtained the following results, using agar, which, though less delicate than gelatine, is simpler to work with:—

THREE DAYS' GROWTH ON AGAR AT 37° C.

(1) Unwashed hands..	Countless colonies.
(2) Washed for five minutes in soap and water without using nail-brush	34 colonies.
(3) Ditto, as above, but using nail brush	12 „
(4) As above, but in addition scrubbed with a sterilised towel	No growth.

Consequently, since making the above experiments (March, 1906), I have always rubbed my hands with a sterilised towel. After scrubbing with the towel, I dip my hands consecutively in methylated spirit, "strong mixture," and corrosive sublimate (1—1000).

Gloves.—Throughout the operation I wear rubber gloves. To test the efficiency of gloves the following thread and agar plate tests were tried.

	After 24 hours	After 3 days
(*a*) My own hands after washing and drying with a towel	No colonies ..	Numerous colonies (probably *subtilis*).
(*b*) Lieut. W.'s (my assistant at operations) treated as in (*a*)	„ „ ..	Some colonies.
(*c*) My gloves on hands *before* operation	„ „ ..	2 colonies.
(*d*) Lieut. W.'s gloves on hands *before* operation	Five colonies ..	29 „
(*e*) My gloves on hands *after* operation	No colonies ..	4 „
(*f*) Lieut. W.'s gloves on hands *after* operation	Eight colonies..	32 „

Conclusion from the above Experiments.—That the wearing of gloves in my case was fairly efficient. Haegler seems to conclude that the infection of the gloves is by one's own hand. Were this so in my case, I think there would have been more growths from the gloved hand after the operation than was the case. Moreover, from experiments (*a*) and (*b*), it will be seen that Lieutenant W. was more successful in disinfecting his hands than I was; but from experiments (*c*) and (*d*), it is evident that his "gloved hand" results were much less satisfactory than mine. He was wearing a pair of new gloves, whereas I was wearing a pair that had been used several times. Why his gloves should have been infected

previous to operation I do not understand, unless he inadvertently infected them in putting them on, as both his pair and mine were sterilised by boiling in the same saucepan. I may state, however, that I am always particularly careful, in putting on gloves, to handle them as little as possible with the ungloved hand. Of course it is unjustifiable to draw conclusions from one set of experiments, but I give them for what they are worth.

Air of Operating Room.—This was tested on one occasion, before and after an operation, by means of gelatine plates exposed for five minutes. After three days the plates were examined with the following results:—

The plate exposed before operation was sterile.

The plate exposed after operating (eight people in the room) for half an hour showed thirty-four colonies. On microscopic examination rod-shaped bacilli, retaining stain by Gram's method, were detected.

The obvious conclusion is to have the room as empty as possible, and to avoid conversation and movement. I never wear a cap or a mouthguard, nor shall I do so, especially the latter, until every other possible source of infection has been eliminated. A mouth guard is most uncomfortable, and I cannot believe that a cap, unless it thoroughly covers the head, is of the slightest use. To keep one's hair short and not to breathe into the wound are obvious surgical first principles.

Guarding the Operation Area.—For all operations about the abdomen I use a sterilised sheet which covers the patient completely. It has a slit in the middle. The edges of the slit, which are arranged to correspond roughly with the proposed incision, are then stitched lightly to the skin to fix the sheet. The skin incision having been made, the interval between the incision and the sheeting is filled up with gauze which is lightly tacked to the patient's skin. The knife used for making the skin incision is not again used during the operation.

Instruments.—These are, of course, always boiled, except cutting instruments, which are kept in 1 to 20 carbolic. Before using an instrument I invariably dip it in sterilised water to get rid of the excess of carbolic lotion. For swabs, sterilised gauze wrung out in distilled water is used. No one handles either swabs or instruments except myself and the officer who is assisting me. I never use any lotions except sterilised water, though I frequently dip my hands in 1—1000 perchloride.

Ligatures and Sutures.—For ligatures silk is invariably used,

TABLE.

Serial Number	Disease	Operation and date	Date of dressing	Result of cultures
1	Onychia ..	Removal of nail matrix, 2.1.06	9.1.06	10.1.06, broth sterile; 13.1.06, growth. Sub-culture on agar, a few non-motile cocci.
2	Varix ..	Excision of veins, 2.1.06	9.1.06	10.1.06, broth sterile; 13.1.06, sterile.
3	Appendicitis	Removal, 3.1.06	10.1.06	11.1.06, broth sterile; 13.1.06, growth. Sub-culture on agar, actively motile diplococci.
4	Ventral hernia following old appendical abscess	Repair of abdominal wall, 4.1.06	10.1.06	11.1.06, broth sterile; 13.1.06, growth. Sub-culture on agar, a few non-motile cocci decolourised by Gram.
5	Varicocele ..	Excision of veins, 4.1.06	10.1.06. A small sinus leading down to ligature; no purulent discharge	13.1.06, growth. Sub-culture on agar, numerous organisms, some in heaps, some in chains; a few diplococci. The chief organisms were apparently staphylococci.
6	Omental hernia	Radical cure, 5.1.06	11.1.06	14.1.06, growth on broth. Sub-culture on agar, a few cocci, decolourised by Gram.
7	Hernia ..	Radical cure, 28.1.06	3.2.06	4.2.06, growth on broth. No sub-culture made.
8	Onychia ..	Removal of nail matrix, 28.1.06	3.2.06. A drop of pus in each nail matrix	Examination showed Staphylococcus.
9	Varicocele ..	Excision of veins, 28.1.06	3.2.06	4.2.06, growth on broth. Sub-culture on gelatine, numerous non-motile cocci stain by Gram, probably staphylococci.
10	Varix ..	Excision of veins, 28.1.06	3.2.06	5.2.06, broth sterile.
11	Hernia ..	Radical cure, 11.2.06	20.2.06	21.2.06, growth on broth. Staphylococci subsequently recovered.
12	,, ..	Radical cure, 13.2.06	22.2.06	24.2.06, growth on broth. Sub-culture gelatine liquefied in 48 hours; rod-shaped bacilli, no streptococci or staphylococci detected.
13	Fracture of patella	Wiring of fragments, 21.2.06	3.3.06	5.3.06, growth from subculture on gelatine, staphylococci and streptococci isolated.
14	Strangulated hernia	Radical cure, 22.2.06	3.3.06	Growth on broth in 12 hours; *B. subtilis* isolated, no staphylococci or streptococci detected.
15	Hernia ..	Radical cure, 27.2.06	7.3.06	8.3.06, growth on broth, staphylococci isolated.
16	Varicocele ..	Excision of veins, 2.3.06	11.3.06	13.3.06, growth on broth, staphylococci isolated.
17	Hallux rigidus	Excision of base of proximal phalanx, 27.2.06	7.3.06	9.3.06, broth sterile.
18	Hernia ..	Radical cure, 20.3.06	29.3.06	Growth on broth after 24 hours, staphylococci detected.

TABLE.—*Continued.*

Serial Number	Disease	Operation and date	Date of dressing	Result of cultures
19	Varicocele ..	Excision of veins, 20.3.06	29.3.06	Growth on broth after 24 hours. Agar plate made on 29.3.06 direct from wound showed one colony; on 31.3.06 cocci, with Brownian movement, encapsuled. One Streptococcus detected.
20	,, ..	Excision of veins, 20.3.06	29.3.06	Broth, growth after 24 hours; agar plate made as in No. 19, 48 hours, numerous colonies.
21	Fracture of patella	Wiring fragments of bone, 22.3.06	31.3.06	No growth on broth after 48 hours; agar plate as in No. 19, 48 hours' growth, one colony, probably staphylococci.
22	Varicocele ..	Excision of veins, 3.4.06	13.4.06	Broth turbid after 48 hours; agar plate as in No. 19, 48 hours, 100 colonies. Cocci stained by Gram, probably staphylococci, also rod-shaped bacilli stained by Gram.
23	Hernia ..	Radical cure, 3.4.06	13.4.06	Broth turbid after 48 hours. Agar plate, 100 colonies after 48 hours, numerous cocci, probably staphylococci, also rod-shaped bacilli stained by Gram.
24	Foreign body (needle) in thigh	Removal, 6.4.06	17.4.06	Broth turbid after 48 hours, non-motile cocci; agar plates sterile after 48 hours.
25	Varix ..	Excision of veins, 6.4.06	17.4.06	Broth turbid after 48 hours. Agar after 48 hours, three colonies proved to be streptococci.
26	,, ..	Excision of veins, 12.4.06	22.4.06	Growth in broth after 48 hours. No growth on agar.
27	Hernia ..	Radical cure, 12.4.06. There was a small sinus leading to deep ligature, but no pus	24.4.06	There was growth on broth and agar, organisms not determined.
28	,, ..	Radical cure, 1.5.06	10.5.06	48 hours, growth on broth; numerous colonies on agar; Staphylococcus isolated.
29	Varicocele ..	Excision of veins, 1.5.06	10.5.06	48 hours, broth sterile, on agar numerous colonies; rod-shaped bacilli stained by Gram; staphylococci not detected.
30	,, ..	Excision of veins, 5.5.06	13.5.06	48 hours, growth on agar, numerous colonies; non-motile bacilli, short rods with rounded ends; staphylococci not detected.
31	,, ..	Excision of veins, 5.5.06	13.5.06 Slight redness about stitches, but no pus	After 48 hours, growth on agar, numerous colonies, same organism as in No. 30; no staphylococci detected.
32	Hernia ..	Radical cure, 5.5.06	13.5.06	After 48 hours, growth on agar, numerous colonies; non-motile cocci, probably staphylococci.

except for septic cases. I tested the effect of boiling silks to ascertain the minimum time they could be boiled with safety, with the following results :—

No. 12 silk boiled for one hour, two hours, three hours, and four hours respectively. Broth cultures were made. After five days every tube was found to be infected, except that containing the silk boiled for four hours. (The boiling was done in an ordinary saucepan with a cover.)

No. 12 silk placed in a test-tube and autoclaved under a pressure of 10 lbs. for half an hour proved to be sterile after five days.

No. 12 silk boiled in a test-tube for a quarter of an hour on three successive days was sterile after five days.

The conclusion from the above experiments is that you can use silk No. 12 with safety if you boil it for not less than four hours, autoclave it for half an hour, or boil it for a quarter of an hour on three successive days. Boiling for four hours, however, rots silk and renders it most brittle. This is well shown by the following experiments I made to ascertain the breaking strain of the different sizes of silks.

BREAKING STRAIN IN POUNDS.

No. of silk	Before boiling	After 10 mins. boiling	After 1 hour	After 2 hours	After 3 hours	After 4 hours
2	4	4	6	3	2½	½
7	11½	12	14	14½	12	11
10	16	16	20	19½	17	10
11	17	19	23	..	17	10
12	18	21	28	..	12	11
12	After ¼ hour boiling on three successive days breaking strain was 26½ pounds.					
12	After ½ hour in autoclave breaking strain was 25½ pounds.					

In every case, with the exception of No. 7 silk, which bore the greatest weight after two hours, the breaking strain was greatest after one hour; after this it rapidly diminished.

Boiling on three successive days is inconvenient, so I am now using autoclaved silk. I put up a few strands, such as may be required for a single operation, in test-tubes according to sizes and then autoclave them. If one end of a skein be cut the strands will be found of a suitable length for most operations.

Sutures.—Throughout the series of operations referred to in the table silkworm gut has been used.

Lotions.—These are always made up fresh by the sister-in-charge of the theatre before each operation. As is well known, antiseptics lose their power by keeping, especially carbolic.

Whilst dressing the cases I wear gloves and observe the strictest aseptic precautions. Great care is of course necessary, otherwise one may infect the broth and agar and thus get fallacious results. On removing the dressings, I cut the sutures with scissors sterilised by heat, and place the sutures in broth or agar media and incubate and examine them in the usual manner.

Over thirty consecutive cases have been treated in this way, and although the results have been satisfactory from a surgical point of view, that is to say, primary union has been obtained without a sign of suppuration, it has only been occasionally that the wound could be pronounced to be bacteriologically sterile.

NOTES ON MODERN BARRACK SANITATION.

By Major E. C. FREEMAN.
Royal Army Medical Corps.

The housing of the soldier is so important a question that no excuse is needed for returning to the subject. No exactly similar problem presents itself in civil life, large schools and lodging houses coming nearest. In a former article in the Journal an effort was made to sketch improvements possible in our older barracks. It is proposed now to indicate some of the sanitary alterations which have been effected for the benefit of the soldier in barracks, now building or recently built. In the Eastern District—where the writer was recently serving—specimens of the oldest and the newest barracks exist almost side by side, and the contrast between them is startling and very interesting.

In the older barracks the buildings are surrounded by a high wall, topped with broken glass, giving the place the appearance of a prison, and making the atmosphere stuffy and confined. This is replaced nowadays by a light iron railing, pleasing to the eye and giving free admission to the air. Instead of the forbidding architecture of the old barracks, the buildings nowadays are of cheerful elevation, generally in red brick. In the guardroom we no longer find the men on duty provided with the plank-bed as of yore, but allowed ordinary cots to lie down on, while the prisoners' cells are light and well ventilated. The barrack rooms are in two stories with verandahs, and little detached blocks contain rooms for sergeants, and for keeping stores. On each landing the visitor meets a niche with concrete base and tiled sides, intended to receive the time-honoured urine tubs. These ancient survivals will not be got rid of till the newest barracks—which at present exist only on paper—are built. Conservatism has struggled successfully for their retention so far, although their dirtiness and the risk of dissemination of typhoid attaching to them has often been pointed out. Lavatories of simple, but effective pattern, with four basins, are common to every two rooms, and here are placed "mop cupboards" with cement floors and walls in which to keep the mops, brooms and cleaning materials. The barrack rooms themselves are smaller than of old, accommodating twelve men, and are distempered in colour, the number of windows and ventilators is increased, and tiled fireplaces with solid hearths give greater heat into the rooms, which present a light and cheerful aspect.

Three systems of lighting are at present on trial. Incandescent gas mantles, carburetted gas and the incandescent electric light. All seem to give good results, especially when we contrast them with the miserable illumination which the soldier has been accustomed to in the past. The choice of system must depend upon circumstances: carburetted gas is expensive, electric light not everywhere available, and incandescent mantles are broken if there is much traffic in the rooms overhead.

In Gujerat barracks a couple of cubicles have been experimentally fitted up, but the system is not likely to be proceeded with as the cost is great; and it seriously interferes with ventilation, and necessitates heating by hot water pipes, as well as encouraging the accumulation of dirt. The cubicle must also be condemned on disciplinary grounds.

The dining hall in the newest barracks is now an accomplished fact; four are provided for each battalion, grouped in pairs. Between each pair is a kitchen, which serves the two halls and heats the hot water pipes and the baths. Thus each half battalion has its complete dining, cooking and bathing establishment. These halls are used at present for meals only, but there is no reason why they should not also be utilised as recreation or class rooms, so as to prevent the multiplication of apartments which all have to be scrubbed and cleaned, a duty which the soldier, and especially the recruit, much detests. The kitchens are spacious and well ventilated, with tiled walls, and furnished with large kitcheners of various patterns, "Dean's Improved" and "Warren's," for example. Pantries and sinks are provided in the lobbies between the kitchens and dining halls.

The flooring of these places presents a difficulty. Wood gets dirty, cement cracks and powders away, stone pavement is very cold to the feet and wears unevenly, so that it is difficult to find a smooth impermeable surface which shall be satisfactory.

Near the kitchens, and supplied with hot water from them, we find the baths, of enamelled iron, each bath partitioned off, and in every way arranged to make the path of cleanliness pleasant. Shower baths are also provided in the latest buildings. In connection with the bath house are the drying rooms, one per company, heated with hot water pipes, and hung with pegs. These are intended to receive the clothing which has got soaked during route marching or other military duty, so that it need not be hung up wet in the barrack room. This arrangement, when properly supervised by the regimental authorities, has proved very successful.

Great coats experimentally saturated with water dried completely in six hours.

Latrines have undergone progressive development since the continuous trough pattern of water closet was first installed in barracks. These gave place to an improved form with a separate container to each seat, and these in turn to separate pedestal wash-down closets.

It has now been found possible to provide each closet with a separate three-gallon flush set in motion by pulling a chain in the usual way, and refilling in about a minute—so that the periodical flushing, with the insanitary accumulation of fæcal matter between whiles, will be a thing of the past. It has been found that the wooden seats of the closets—of whatever pattern made—get fouled, so a new form, called the "inserta seat," has been brought into use. The seat is here replaced by two lateral wooden " pads " fixed into the earthernware rim of the pedestal, so that no wood work at all is exposed to possible contamination. Coincidently with this the drainage system has been improved on the most modern lines, with disconnecting traps and inspection chambers of the newest pattern. These are usually connected with the local system of sewerage, but in a few instances a separate biological treatment of the sewage of the barracks has been installed. Latrines are of amber-ware and stoneware, instead of the old slate slabs.

The coffee shop, supper room and regimental institutions generally, are now lodged in spacious, well-ventilated apartments, and made bright and cheerful with pictures, curtains and coloured walls. Indeed, the supper rooms, with their marble-topped tables and ornamental palms, often present quite a café-like appearance. The large recreation rooms have a permanent stage with dressing rooms underneath, and are heated throughout with hot water pipes. The present tendency is to discourage "soaking" in canteens, and to encourage the men to take their beer and then turn to some rational amusement. "Wet canteens" or drinking bars are therefore built of moderate dimensions only, with limited sitting accommodation, and the same arrangement is followed in the sergeants' messes. In these latter the main room is divided into writing and dining rooms by a movable partition.

The water supplies are as a rule derived from local or municipal sources. In Norwich they are from a water company, and in Bury St. Edmunds and Landguard from Government wells. The local supply is in each case passed through storage cisterns in the barracks to prevent any temporary water famine, should the

supply be cut off at the main. This arrangement is regarded as indispensable for all large buildings such as barrack blocks and stables, but it is now recognised that cisterns are always possible sources of pollution, and in the newer barracks taps for drinking water are attached to the service pipes, so that the soldier drinks only the incoming water, and uses the cistern water for washing, &c., only. The small cisterns formerly supplied to each married quarter are abolished in the more recent buildings, a matter for congratulation, as they are always sources of danger, being difficult to keep clean or even properly covered.

The married quarters also share in the general improvement; they contain more rooms, and each quarter has its separate water closet. The sculleries have been enlarged, so that washing can be done at home—a very popular arrangement—and the money saved by the suppression of the wash-houses goes to improve the quarters, which are now finished off with tiled floors in the passages, and washable paint in the annexes.

The officer profits least by these advances in sanitation, and with few exceptions messes are still unprovided with any sort of bathrooms. Sleeping accommodation for mess servants is still a *desideratum*.

Very different from the above is the condition of the men quartered in some of the older barracks. Something no doubt has been done for these, but more might still be effected at no great cost to the State. The difficulty is that the authorities are in many cases undecided whether these old barracks are to be retained, or rebuilt elsewhere—many of them being now, owing to the growth of population, in the centre of thickly inhabited districts. In the meantime everything has to be kept in *statu quo*, and it is devoutly to be hoped that microbial diseases will recognise the state of affairs, and proclaim a truce until the official decision on these buildings is announced. Meantime we may safely say that, in the newer barracks, the soldier is better lodged and cared for than most members of the community.

The writer had recently, by the courtesy of the secretary, an opportunity of going over one of the largest of the Rowton houses in London. These houses are often held up to us as a model for barracks. Undoubtedly they are wonderfully good in construction and arrangements, but the problem of their construction is really quite dissimilar to that of barracks. In the first place they have only to accommodate their inhabitants with dinner, bed and breakfast; the greater part of the day they are empty, so that there is no

hindrance to cleaning operations, which are facilitated by the use of tiles, cement and impermeable surfaces wherever possible—an arrangement which is hygienic, but which, if applied to barracks, would put too heavy a burden on the long-suffering tax-payer. In the next place, the idea of cubicles for soldiers is certainly taken from the Rowton houses, but the soldier is one of a corporate body and the inmates of these houses are isolated individuals unconnected with one another, merely seeking a night's lodging. Finally, in barracks we have not only to house, but to educate, develop and discipline our men, and this requires quite a different system to that of the Rowton houses, where the only and sufficient penalty for misbehaviour is—to be turned out. In the Rowton houses a special staff is kept up for cleaning purposes, in barracks nowadays the men are so constantly on duty that it is difficult to get the fatigue men necessary to keep the place in order. Therefore it is advisable to have everything of the simplest, and to avoid as far as possible additional labour. The Rowton houses have a special and up-to-date laundry of their own—a feature which might perhaps be copied in our barracks with advantage.

At present the tendency in the Army is to do away with the laundry and to allow the washing to be done at home, larger sculleries being built for the purpose. The drawbacks to this, of course, are the damp and steam generated in the dwelling and the accumulation there of dirty garments; but, on the other hand, many women always did do their washing at home, even when a laundry was provided, and the evil is minimised by a large well-ventilated scullery. Besides the laundry question, which is still in the experimental stage, one or two disputed points may be touched on.

In some places the self-flushing water closets are found not to answer, and some form of automatic flush is recommended instead. No one doubts that the self-flushing system is the more sanitary, and its misuse by the men will soon be got over by time and education. If the people who live in Rowton houses can be trusted to use self-flushing closets, surely the soldier can too! The amount of flush per closet has been laid down at two gallons, but it has been found that two such flushes are required to wash the excreta properly into the drain, while one three-gallon flush will do the work; hence the latter is more economical of water and has been adopted throughout this area.

The following details of the modern barrack room may be of interest. The room is thirty-six feet long by twenty-three-feet six

inches wide, and ten feet six inches high. It accommodates twelve men, and has three windows, two feet six inches by six feet, on each side. A bed is placed in each corner and the remainder in pairs dividing the space between the windows. At the end of the room opposite the door is a fireplace of glazed fire-brick, with solid hearth; in connection with it is a warm air inlet and a foul air extractor. In addition louvred ventilators are inserted between the beds, thus ample ventilation is secured as well as ample cubic space. At the other end of the room a small ventilated cupboard is provided for cleaning materials only, as dining halls do away with the necessity for any food being kept in the barrack room. "Mop cupboards" have not proved a success and will probably not be repeated, as they get musty and dirty; some kind of rack for brooms, &c., would be much better, but then the question of their safe custody would arise.

The sergeants have quarters quite distinct, separated from the men's rooms by the whole width of the verandah which runs along the front of each barrack room. There is one "sergeant's bunk" and one company store room to each pair of barrack rooms.

A convenient and well-lighted medical inspection room is now provided, one for every two barracks, with water laid on, cupboards, &c., and a large waiting room attached. This is a very necessary improvement now that so many cases are to be treated out of hospital.

THE TREATMENT OF ENTERIC FEVER BY THE "EMPTY BOWEL" METHOD.

By Lieutenant-Colonel G. CREE and Captain G. B. CARTER.
Royal Army Medical Corps.

The treatment of enteric fever by the "empty bowel" method is based on the highest scientific principles, and has given most excellent results in this station (Wellington). Our cases in Wellington have been of necessity limited, but we all feel sure that our line of treatment is sound, and deserves a fair trial in other stations where the cases are more numerous, and when a more definite opinion can be formed as to its undoubted merits.

We do not claim our treatment to be "new," but we have, by observation and by gradually combining and eliminating certain points in other methods of treatment, finally adopted a general routine method of procedure in *all* enteric cases, and it is this we shall attempt to describe. It will be seen that we only give the general broad lines of treatment in these cases, as any one who has seen much enteric fever knows that no other disease shows so many different features in individual cases, and that each case, therefore, must more or less be treated on its individual merits.

The following is our method, and we propose to give only the special points in: Dieting; Nursing; Isolation and Disinfection; Temperature Charts; The Stools; Medicinal Treatment; and a few points on the most common complications.

Dieting.—This we all know is a most important point in the treatment of this disease. Here we place the patient on whey, made with the juice of fresh limes. We prefer to make our whey in this manner to using "rennet," for the following reasons: It is much more palatable; the lime juice seems to have a beneficial effect on the course of the disease, as shown below; and cheapness.

This whey requires very careful preparation, and must *always* be made by the nursing sister in charge of the patient, to avoid any possible error, and it is a sound thing for the medical officer himself to see it daily. Limes vary in size; the average lime gives about a drachm and a half to two drachms of juice; it requires four drachms to make a pint of whey; four pints of milk give three and a half full pints of whey, allowing for wastage, &c.; therefore, roughly, eight average limes will make three pints of whey, which we find is ample for a patient in the early stages of the disease.

The way to make it is, the lime juice is added to the warmed milk, and the whole then just brought to the boiling point, and allowed to stand until a firm clot is obtained. The curds are then broken up and removed carefully by straining through muslin. One straining is not sufficient, it must be strained two or even three times. In some of our early cases curds were found in the stools, presumably because the whey had not been strained sufficiently, and maybe some further clotting had occurred in the stomach. For this reason we have pointed out the great importance of the nurse herself preparing the whey. When made it can easily be kept fresh in a covered vessel in the ice-box.

Lime Juice.—The patient is given lime drinks made from fresh limes *ad libitum*, for the following reason: A patient suffering from enteric becomes undoubtedly scorbutic, and therefore the alkalinity of the blood must be, of necessity, diminished. By giving lime juice we claim to prevent, or at least diminish, the symptoms of this lowered alkalinity, such as: (*a*) Hæmorrhagic tendencies, whether intestinal or otherwise; (*b*) phlebitis; (*c*) thrombosis; (*d*) spongy gums; (*e*) and in addition, it is possible that the lime juice may have some direct action in preventing salivation from calomel, which we use in our treatment, as we shall show later; (*f*) perhaps also, continuous drinks of lime juice may have an antagonistic action on the *Bacillus typhosus* itself, as we know the bacillus grows best in a nearly neutral medium.

Chocolate.—We give our patients plain chocolate to suck. It is extremely grateful, and prevents that intense craving for food, which is invariably present. It has also considerable nourishing properties. This was suggested to us by Lieutenant T. J. Wright, R.A.M.C., and is prescribed by Dr. Little, of Dublin.

Pure Vegetable Soup.—This soup, carefully prepared and strained through muslin, is given immediately the temperature reaches normal. It is greedily taken by the patient, and helps to shorten the protracted convalescence so often present.

Ice.—Ice to the head and ice to suck *ad libitum* is ordered; it is soothing to the patient and has also an antipyretic action.

Milk.—We have found that milk in alternate feeds with whey is very acceptable to the patient, about the third or fourth day after the temperature reaches normal, but should be given with the greatest caution. Whey fortified with cream is also a valuable adjunct in the early convalescent stage.

Tea or Coffee.—A cup of weak fresh tea or coffee is absolutely innocuous, and is greedily taken by the patient.

Soda Water.—Under no circumstances should soda water be given. It only causes distension and flatulence.

Beef tea and chicken broth are of no value in the stage of pyrexia, and undoubtedly, at times, do harm.

By adopting this line of dieting we avoid that awful sameness of food which is so distressing to the patient in a prolonged illness of this kind, and yet give nothing that a debilitated digestive system cannot deal with.

Nursing. Nurses.—No disease requires more careful nursing than enteric fever, and therefore it is of vital importance that an experienced nurse is in constant attendance on the patient. *Mere supervision* by the nurse is insufficient. The nurse should *herself* prepare and give the feeds, wash the patient, and change his linen, and take the temperature, pulse, &c.

Cleanliness of the Patient.—The patient must be kept scrupulously clean, and he should be washed all over with soap and hot water at least twice a day. How often do we see a patient, who has been restless and tossing about in bed, drop into a quiet and refreshing sleep after having been washed down in this manner. In addition, his anus and nates should be carefully washed with a soft cloth immediately after each motion, and all soiled linen at once changed.

The Care of the Mouth, Teeth and Gums.—The care of the teeth and gums is also a very important point, and requires constant attention. A soft tooth-brush and Odol, if procurable, are excellent.

Shaving.—If accustomed to shave, let the patient be shaved daily. It adds greatly to his comfort and general sense of cleanliness.

Clothing.—A nightshirt which opens down the side is also a great comfort to the patient, and prevents his being moved more than necessary.

Bed Sores. Their Prevention.—The patient's buttocks should be, from the first, rubbed daily with methylated spirits to harden the skin; but there are other causes of bed sores, viz., want of cleanliness; want of care in seeing that the patient's nightshirt is not evenly drawn down, and is not in folds under his buttocks; want of care in making his bed and careful attention that the sheet is not crumpled underneath him.

Isolation and Disinfection.—All suspected cases should be immediately isolated and kept under observation, as it is impossible to diagnose the disease with any certainty in its very early stage. Afterwards, complete isolation is, of course, essential. All soiled clothing and bedding must be immediately disinfected. All excretions from the body, whether from intestines or bladder, and even

the sputa, should be immediately removed and burnt. It is not impossible to imagine that the sputum of an enteric patient is a source of danger, for how can we otherwise account for bronchitis, which is not a complication, to our mind, but is an almost constant symptom of the disease.

Temperature Charts.—A four-hourly chart is essential. The temperature fluctuates enormously in the twenty-four hours, and a case can easily be lost by simple hyperpyrexia if this precaution is not adopted. The pulse also must be carefully taken and its characters noted. The main danger signals in enteric are a rising temperature with an increase in pulse-rate—a rising temperature is bad, but a rising temperature and, *pari passu*, an increase in the pulse-rate are infallible danger signals; again, also by noting the characters of the pulse can we estimate, with any degree of certainty, whether stimulants are indicated or contraindicated.

The Stools.—Each stool must be kept and seen daily by the medical officer. It is the great indication of (*a*) whether the dieting is satisfactory; (*b*) the condition of the bowel.

Another aid to these two important points is the condition of the abdomen, whether flatulent and tympanitic or flaccid and soft; this, we think, cannot be over-estimated as a guide to treatment. Here we insist on the nursing orderly being himself responsible that each stool passed by a patient is placed in a covered receptacle labelled with the name of each individual patient.

Medicinal Treatment.—On admission the patient is given the following: calomel, grs. v.; soda bicarbonatis, grs. x. This is followed by a dose of castor oil with a view to (*a*) a free and copious evacuation of the bowel, (*b*) an attempt to prevent, or at least minimise, as far as possible, the absorption of toxic substances; in fact, an "abortive treatment." In all cases of intestinal poisoning, whether ptomaine, dysenteric or choleraic, we all prescribe purgatives in the early stages with these objects in view; why, then, should we not adopt this treatment in the early stage of enteric fever, which is an intoxication process? Subsequently, we prescribe daily, calomel, gr. i.; bismuthi salicylatis, grs. x., *ter in die*, and castor oil every morning in drachm doses. By this line of treatment we claim, if not to abolish, to at least decrease enormously all the "bowel complications," which are, after all, the main sources of danger in this disease. We continue this administration of calomel and castor oil daily, throughout the whole attack, and when we see three, four, or even five loose, watery, dark, generally almost black stools, free from curds, we

feel confident that both our dieting and medicinal treatment are satisfactory.

It will surprise any one, even the sceptic, who cares to give the whole treatment a fair trial, to note (*a*) the soft, moist, clean tongue, (*b*) the flaccid and soft abdomen, free from distension and tympanites, (*c*) the almost entire absence of bowel complications, and (*d*) the absence of "enteric smell"; instead of (*a*) the typical, dry, foul "enteric tongue," and its discomforts, (*b*) the tympanitic and distended abdomen, (*c*) the resulting constant fear of hæmorrhage, and (*d*) perforation, which we all must have met when treating enteric fever on other lines.

When we think that, in India certainly, constipation, or at least a constipated state of the bowel is the rule, and at home also, we think, a constipated state of the bowel with intermittent diarrhœa is the common feature of the disease, it will readily be seen that if we take the two main and most feared bowel complications, namely, hæmorrhage and perforation, and consider for a moment how constipation, or a constipated state of the bowels, or undigested food, must of necessity increase the danger of these complications by a purely mechanical effect, namely, the friction of a foreign body "on the necrosed intestinal wall," that *any treatment* which attempts to insure an "empty bowel" must be the *summum bonum* of treatment, and must place the patient in a far more secure and favourable position than he could otherwise be in. How often does one see the whole efforts of treatment directed to control this diarrhœa, which is not really constant but intermittent diarrhœa followed by a constipated state of the bowel, forgetting that the patient's greatest chance of avoiding the two main intestinal complications is by having an empty bowel, and thus allowing the normal peristaltic movement a "free hand," as it were, to prevent, by contraction, these two complications occurring, which, of necessity, are far more liable to occur with a distended bowel. Again, by giving calomel we increase the hepatic secretions, and thus insure a constant flow, if not of an antiseptic fluid, at least of an aseptic fluid, through the diseased bowel, and thus we have (1) asepsis, and (2) "a rested bowel," and we thus place the necrosed intestinal wall in the best possible conditions for recovery.

Calomel may be given without fear throughout the whole attack. We have never found any tendency to salivation or diarrhœa. The former only occurs when the calomel is allowed to accumulate in the system, and therefore, by prescribing castor oil, we eliminate this danger. Again, when adopting this treatment we must draw

attention to the extreme importance of insisting on the care of the mouth, gums and teeth.

Scheube in his book "On the Diseases of Warm Climates," page 474, 1903 edition, advocates calomel in the treatment of dysentery, and claims a "specific action" for the drug, even in preference to ipecacuanha. May we dare to suggest that it is possible that the primary action of calomel is on the liver, and thus, by increasing hepatic secretion, causes the continual flow, if not of an antiseptic, of at least an "aseptic fluid" through the intestine. This must also, surely, be the action of sulphate of magnesia in the treatment of dysentery, &c.

Stimulants.—Avoid stimulants in the early stages unless, of course, specially indicated. The main indications for stimulants are the conditions of the pulse, the mental condition, restlessness, and low muttering delirium.

Special Points on Complications. Relapse.—The most common perhaps, due generally to errors in (*a*) dieting or (*b*) nursing. Therefore more particular care should be paid to these points.

Hæmorrhage.—The treatment here undoubtedly is starvation, ice to the abdomen, ice to suck, absolute rest both mental and physical, nursing, and avoid stimulants. Of drugs, we have found adrenalin chloride in small repeated doses very useful.

Hyperpyrexia.—Antipyretic drugs are contraindicated, except perhaps quinine. In India it must be remembered that it often happens that a patient may have, concurrently with an attack of enteric fever, malarial fever. This is shown at once by the four-hourly temperature chart, and is confirmed, of course, by a blood examination; and here quinine may be given, preferably the acid hydrobromate of quinine or the acid hydrochlorate, as being the most easily digested. Otherwise it is best to rely on other means for reducing the temperature, beginning first with ice to the head and ice to suck, then sponging with tepid water, sponging with cold water, sponging with ice-cold water, the ice pack, and finally the ice bath. But here we must point out the danger of this mode of treatment in this country, and it must be used with the greatest precaution on account of shock. In the later stages of the disease one sometimes gets hyperpyrexia, with the patient in a condition unfit to bear the last-mentioned methods of reducing his temperature, and in these cases we have found that sponging with very hot water will often bring the temperature under control, and this line of treatment acts also as a direct stimulant to the patient

Sleeplessness.—We have found sulphonal in small repeated doses acts best, and in prescribing this drug we must remember that it takes some time to act, and therefore should be given about three to four hours before its action is required. Paraldehyde is an excellent hypnotic, and has also direct stimulant properties.

Perforation.—I have mentioned this last, as the only course of treatment is obvious.

In conclusion, in writing these notes on the treatment of enteric fever as practised in Wellington, our only object is mainly to give a general line of treatment for junior officers coming out to this country who, perhaps, have not had the opportunity of seeing many cases at home, and to whom therefore, perhaps, these notes will be of some assistance. But if they propose to follow our line of treatment we must point out that the whole details of our treatment are essential, or otherwise they must meet with many failures.

INDIAN INVALIDING.

By Colonel R. H. FORMAN.
Royal Army Medical Corps.

Those of us who have any practical acquaintance with the subject and who have had to deal with it, directly or indirectly, are aware that the arrangements for the transit of invalids, for their care *en route*, and for their comfort generally, are far from being ideal. To those, the remembrance of the long hot journey in comfortless trains, the frequent changes, the delays in rest camps, the unsuitable and unappetising dietary, the heart-breaking long-drawn-out sojourn in Deolali or Colaba, and the packed discomfort of the troopship, recall memories crowded with pathetic incidents. It is not creditable to us—to use no harsher term—and it makes us wonder why we, of all nations, who pride ourselves on our humanity, and whose political and territorial position, of necessity, means constant wastage through sickness, should lag so far behind, and fail in what, it must be admitted, is a primary duty of our civilisation—the anxious and tender care of those who have lost their health in their country's service. It has been my fortune or misfortune (depending on the standpoint from which the matter is viewed), to be closely associated with this question during many years, and I lay claim to a certain amount of expert knowledge regarding it. I had a great deal to do with the transport of the sick and wounded from the Afghan campaign in 1880; later on, in 1886, I was practically in charge of the whole of the invalids from the Punjab, North-West and Central Provinces, from the start of their journey till their final arrival at Netley; still later, I had experience in the conveyance of sick per Royal Indian Marine, and as recently as 1904 I went home in medical charge of the s.s. "Plassy," which ship had been specially fitted for the conveyance of invalids. In these, and many other instances, I saw much that forced me to think, and during the whole of my service I have never failed to press the matter home, when opportunity was afforded to me, to try and prove that our system was faulty, and to do what in me lay to ameliorate the lot of these unfortunates. I do not mean to assert that nothing has been done since those early days of which I speak, far from it; on the contrary, there has been a distinct advance; but, I do assert it, whatever advance

has been made is not commensurate with requirements—not a final solution of the problem confronting us nor in keeping with our bounden duty. I am willing to admit, as everyone must, that military exigencies on active service must on occasion override all other considerations, but I see no reason why, in times of peace, the transport of sick should involve any hardship whatever; indeed, I will even go further and express the opinion that transport in many cases should prove actually beneficial.

"There is a providence that shapes our ends," and I could almost imagine that my appointment as Principal Medical Officer, Bombay Brigade—the fountain head of invaliding, so to speak—was of this nature, affording me an opportunity, yet once again, to express my views with a certain degree of authority, and perchance to bring the goal a little nearer. Be this as it may, it is a fortuitous and encouraging fact that a short time ago the Principal Medical Officer H.M. Forces in India, in passing through Bombay, made certain inquiries relative to invaliding, and instructed me to draw out a scheme and to submit it to him for consideration. This I accordingly did, and it is now *sub judice*. It is not my intention in what follows to reproduce that scheme, even in outline, but rather to indicate in general terms the inherent faults of our present system, and as briefly as may be suggest the remedies.

Looking at the matter, then, on these broad lines, it seems to me that the most flagrant inherent fault is an administrative one. We talk glibly of Administrative Officers, but few realise, except those who have held such an appointment, how very helpless a Principal Medical Officer is, and this applies not only to those of Divisions and Brigades but upwards, right to the top. We can but suggest; in others is vested the application, and these others are not only laymen, but are specialists in other branches of military science, and consequently fail to grasp proportions. In the mind of a General, the fighting efficiency of an army looms large; in that of a Scientist, it's health. The General is as unfitted, by knowledge and training, to deal with questions of hygiene and sickness, as the Doctor is with those of strategy and tactics. Why, then, is the former called upon to decide questions outside his range of knowledge? "The cobbler to his last" is an aphorism deserving of a wider application in military organisation than is usually accorded to it, and when the time comes, if it ever does come, that this simple axiomatic fact is recognised, then, but not till then, we may hope to attain to practical efficiency. Administration is but a mere figure of speech unless it is coupled with executive authority, and

no man, or body of men, can maintain a vigorous initiative, or perfect a system, if all their efforts are continually frustrated by a wet-blanket of unappreciative conservatism. Now, nowhere is this more marked than in this very question of invaliding. Let anyone examine the facts as they stand and, if he is candid, I venture to assert that he will admit that this is so. Study the telegrams and letters, and what do we find? Nominally, the General Officer Commanding of an up-country command communicating with the General Officer Commanding, Bombay; in reality, their respective Staff Officers; for anything Divisional and Brigade, Principal Medical Officers have to do with the matter; they might just as well be non-existent; yet, surely, it is but common sense to suggest that they, with their special knowledge, are the men to do the work, and that the use of an inefficient instrument, when an efficient one is at hand, borders on the ludicrous. I do not for one moment allege that Staff Officers do not do their best, conscientiously and whole-heartedly, but a cobbler is a cobbler all the world over, and if he aspires to be a blacksmith it is morally certain that he will burn his fingers. Therefore, it appears to me, that if we want invaliding properly carried out—and we all want that—we have here a broad general principle foreshadowed, namely, put it entirely into the hands of the medical department. In other words, give authority to the Principal Medical Officer at the port of embarkation, let him be placed in direct communication with up-country Principal Medical Officers, and, between them, let the matter be carried through. How this can be arranged I will indicate later.

In invaliding the ideal is a hospital ship, fed by hospital trains. In India we have neither. And by a hospital ship I do not mean a hybrid like the s.s. "Plassy," which is in no sense of the word such, but only a sick transport. By a hospital ship I mean a floating dieted hospital, under the direct control and command of the Senior Medical Officer on board, except as regards navigation and the legal responsibilities vested in the captain. Such a ship should not have all her best accommodation allotted to officers and their families, and she should be reserved exclusively for the conveyance of invalids. No man in his senses would think of using a building ashore partly for sick and partly for healthy men. Why, then, should it be done afloat? It is scarcely necessary to add that in *personnel*, fittings and equipment, such a ship should be well up to the standard of modern medical and surgical requirements. In like manner, a hospital train should be a dieted hospital on wheels, its equipments, &c., being only modified by its necessary

limitations. In short, the organisation should be such that an invalid who is seriously ill should—barring any ill effects arising from movements—be equally well attended to whether in a station hospital, a train hospital, or a floating hospital. It is an extraordinary thing that although in recent years many ships have been fitted up at great expense, both by Government and by private enterprise, it has never appeared advisable to anyone in authority to retain one of those ships permanently. It is beyond the wit of man to conceive why a soldier who becomes inefficient during a campaign should be afforded a better opportunity of recovery than his less fortunate comrade who loses his health in cantonments, but equally in the service of his country. One can only account for it by putting it down to the ignorance of the "cobbler-blacksmith," above referred to; or to the glamour and pseudo-patriotism of active service reacting on the warped imagination of an emotional proletariat. So also with hospital trains. I believe I am right in saying that there is not a single continental nation that does not possess these essential adjuncts to its medical equipment; yet we in India, with ten times the necessity, possess nothing of the sort. If one did not know full well that it is not individual apathy or callousness, but is rather the result of collective want of system, one would be tempted to characterise it as criminal. Nationally, it undoubtedly is so.

Under our existing system of invaliding, medical boards assemble in September, January, and, if necessary, February. The s.s. "Plassy"—the so-called hospital ship—was timed to leave Bombay during 1905 in November, January and March. Now if the Principal Medical Officer, India, had complete control of the invaliding, it seems reasonable to surmise that he would make an attempt to let the assembly of boards bear some relation to the available means of transport, and we might be spared the absurdity of interviewing a "cot-case," smoking his pipe and carrying his kit, while his "ordinary-case" comrade is trying, poor wretch, to get his tottering legs to support his fever-racked body. This is no fanciful picture; it occurs continually. The brand of "cot" or "ordinary" appears to be indelible till the haven of Netley is reached, and the brander is the hydra-headed monster we designate "red tape." Elasticity and initiative are what we want, and want badly; but these qualities are conspicuous by their absence, which is perhaps not to be wondered at when we consider that their display, as likely as not, may mean an official snub or a sarcastic comment on officious assumption of authority. Further, the want of connection between

boards and transport is more or less responsible for the existence of rest camps, and has necessitated the maintenance of large hospitals at Deolali and Colaba. A word or two about these.

I do not hesitate to say, and to say emphatically, that rest camps are responsible for more suffering, more exacerbation of illness, more loss of life even, than any other factor in our ill-digested—I had almost said chaotic—invaliding arrangements. There are few of us that cannot conjure up the picture. The long rows of dusty tents, on a bare sun-scorched plain, dreary, neglected, depressing; the lack of even ordinary comforts and equipment, trying to a healthy man, a nightmare to a sick one! the primitive, unsuitable, and even repulsive dietary; add to this environment. A troop train full of men suffering from malarial cachexia, chronic dysentery, and the whole gamut of tropical ailments, arriving mayhap in the raw cold of a December night; the detraining of helpless men and impedimenta at a gloomy, unlighted troop-siding, often enough half a mile or more from the tents, and the weary transit to those tents; some jolted in dhoolies or tongas, others tottering on uncertain feet, and struggling to carry their kits. This is no exaggeration born of sentiment and emotionalism; it is bare, bald fact, as many of us know. I have seen it often. Could anything be worse, could anything be more fatuous? These men, many of them at least have probably for weeks before been housed in comfortable hospitals, carefully treated, tenderly nursed, and generally coaxed along and safeguarded by every means that skill and science can suggest. For what? Apparently to undo at one stroke all the long anxious labour by subjecting them to conditions which are as detrimental as they are unnecessary. Would any of us suffering, say, from chronic dysentery, detrain every twenty-four hours and try the curative effects of rest camp methods and dietetics? I trow not. Then if *we* would not do it why should the soldier be made to do it? I shall be answered that the conditions are not comparable, that the officer can obtain comforts which are beyond the reach of his humbler comrade. I reply: why should this be so, and why should the private not be granted these comforts? For it is a fact, and no man will gainsay it, that morbific influences have not yet been educated to the point of recognising any difference between the colon of the bluest-blooded Vere de Vere and that of poor suffering Private Thomas Atkins. There is a kind of grim humour in the prefix "rest," as applied to these camps; for anything less conducive to rest I cannot conceive, unless perhaps we picture them as mile-stones and adjuncts to the "long rest."

And so also the want of co-ordination between boards and transports is responsible for the weary procrastinations at Deolali and Colaba. Medical officers up country send off their invalids weeks, and often months, before there is reasonable prospect of embarking them. Rightly enough, I think, under present conditions, for there is such a want of systematisation that unless the man is on the spot it is an even chance if he ever gets home at all. The result is, in a lesser degree, the rest camps over again. During the trooping season, the hospitals both at Deolali and Colaba are strained to their utmost capacity; tents are pitched to supplement the existing accommodation; the hospital staffs are overworked and confused by the numerous complicated and serious cases hurled at them, so to speak, in bulk, and such a thing as a close and patient study of clinical history and symptoms is a physical impossibility. The congestion is so great that many men who should be in hospital have to be denied admission; and with all the will in the world the treatment and care cannot compare with that obtainable in the hospitals they have left.

One other point with regard to Deolali and Colaba. It is based on the old, though none the less true, proverb, "Hope deferred maketh the heart sick." All too frequently it happens that ship after ship goes, and accommodation is not available for some unfortunates. I have known of men actually entrained at Deolali and then detrained again, in obedience to a telegraphic order; it is even a fact that invalids have had to be kept till the ensuing trooping season, which possibly some of them never lived to see. It shocks one to think of it. We must remember that we are dealing with men, many of whom are ignorant and without those resources which education can and does confer; that their natural courage is weakened by physical suffering, and that the one thing ever before them is a persistent and a yearning nostalgia. In these days, when the science of psychology is coming more and more to the front, and when the influence of mind on body is recognised as no longer the dream of the faddist or the stock-in-trade of the charlatan, he would be a bold man who would assert that a story told to me by a nursing sister some time ago is nothing more than a figment of feminine emotionalism. She said: "I had a man seriously ill at Colaba. Twice, at the last moment, his embarkation was cancelled, but I cheered him up; and yet a third time it happened." To use her own words as nearly as I can recollect them, "The tears ran down his cheeks; he turned his face to the wall and seemed to give up the battle. He never

left that bed alive." Might he have recovered? Who can say? But the disturbing and distressing fact remains, that it is possible he might have, had our invalid arrangements been what they should be.

Now, if the foregoing is true—and I aver that it is so—then it behoves us to find remedies with what speed we may, for the matter is, I take it, one of urgency. In what has gone before, I have in great measure indicated wherein these remedies lie, and it may be that before this article appears some of them may be in force, for they are embodied in the scheme I have submitted to the Surgeon-General. I do not doubt his willingness to carry them out. What I fear is his want of power. However, for clearness, I detail them in tabular form, premising by saying that, as this article has grown already beyond the limit I contemplated, I must leave further comment to others.

(1) A hospital ship, dieted, large enough to convey all invalids in, say, two voyages; fitted to modern requirements, an integral part of the medical equipment, and completely under the control of the medical department, reserved exclusively for invalids.

(2) One or more hospital trains on the main trunk lines, also dieted, and including amongst the staff at least one nursing sister.

(3) All invaliding to be *entirely* in the hands of Principal Medical Officers of Divisions and Brigades, with the Principal Medical Officer, Bombay Brigade, as the central authority.

(4) Invalids to be separated completely from healthy troops in transit, both by rail and sea.

(5) Invaliding boards to assemble at times co-ordinating with the date of sailing of the hospital ship.

(6) Principal Medical Officers Divisions and Brigades to keep the Principal Medical Officer, Bombay Brigade, fully posted as to the classification of their invalids, and all such detail as will assist him in apportioning accommodation on the hospital ship.

(7) The Senior Medical Officer of the hospital ship to be specially selected, and to hold his appointment for the whole season.

(8) Direct embarkation by Divisions and Brigades; the abolition of rest camps, and the discontinuance of Deolali and Colaba as receiving depôts.

(9) Hospital trains to be through trains, and to run to scheduled time-table. Hence, Principal Medical Officer, Bombay Brigade, can arrange with other Principal Medical Officers for the despatch of their sick, and these latter will be responsible that their invalids are ready at the scheduled stopping places.

(10) The abolition of any further attempt at systematic seasonal invaliding. It is questionable whether it is of much use; it certainly gives rise to great confusion, and any advantages accruing are more than counterbalanced by the disadvantages.

(11) The retention of all documents in the hands of the medical authorities from start to finish.

Such, then, however imperfectly, are my ideas with regard to the present position of Indian invaliding and the reforms that are called for. That to carry them out will involve expense goes without saying, though with equal truth it may be urged that in a matter of this kind expense should be disregarded. Still, there is every reason to fear that the comparative cost-lines may prove the stumbling block, and it is for this very reason, and because the exigencies of the case demand it, that I have forsaken the safe lowlands of platitude to tread the rugged heights of controversy. The humble private soldier has no power to voice his grievances, and we, the doctors of the Army, must speak for him "*In arduis fidelis.*"

Clinical and other Notes.

A CASE OF PARATYPHOID (SCHOTTMÜLLER'S BACILLUS).

By Captain R. S. H. FUHR, D.S.O.
Royal Army Medical Corps.

2nd Lieutenant W. A. Gardiner, attached to The Queen's, was admitted to Lady Robert's Home from Barian Camp, Murree Hills, on October 6th, 1906, as a possible case of enteric fever.

Previous History.—This officer arrived in India on March 8th, 1906, and proceeded with his regiment to the hills on April 23rd. He had not been inoculated for enteric either in England or in India. His health was excellent until September 13th, when he contracted a severe attack of diarrhœa from eating a cucumber obtained from a native village while out shooting. (Note.—His companion, who also ate of this vegetable, did not contract diarrhœa.) This diarrhœa lasted until the 19th, and was accompanied by intense malaise, headache and vomiting, but from the above date until October 2nd he was in good health. He stayed at a hotel in Murree, from which several cases of incipient enteric had been removed on September 20th. On October 2nd he had slight rigors and a little fever, but played through a Rugby football match in Murree in a hot sun, afterwards riding some seven miles back to Barian without changing his clothes. From October 2nd the feeling of malaise, with headache, loss of appetite and fever, steadily increased.

On admission patient, who is 20 years of age, and of slight physique, had a temperature of 101·8° F., pulse 88, severe headache, and tongue coated in the centre with a dry white fur and red and dry at the edges. The face was drawn and anxious in expression, pupils dilated, no rash present. Abdomen somewhat full in outline, intestines loaded. Liver slightly enlarged downwards, with acute tenderness extending into the right iliac fossa. No gurgling present, bowels stated to have acted on preceding day, stool loose and light yellow. The urine was of high colour and specific gravity, otherwise normal. Spleen, heart and lungs, normal. Patient's habits regular, disposition phlegmatic; no family history of tubercle, &c.

Progress of Case.—Pyrexia lasted twenty-two days and was mild in type. No delirium or hæmorrhage of any kind ensued, nor were there any other complications. The stools, although light in colour and deficient in bile for the first fourteen days, were not offensive, nor were they at all like those peculiar to enteric fever.

Six roseolar spots like the enteric appeared on the abdomen on October 10th, and had almost completely faded by the 15th.

Blood reactions, kindly undertaken for me by Major B. H. Scott, R.A.M.C., Sanitary Officer, Northern Command, were as follows: Widal's serum test for *Bacillus typhosus* negative on two occasions. Widal's serum tests for *Micrococcus melitensis*, para-colon, and para-typhoid (Brion and Kayser), negative. No malarial parasites in blood-films.

Widal's reactions with para-typhoid (Schottmüller's bacillus), positive 1 in 40 and 1 in 80.

Treatment.—"Empty bowel," "postural," and calomel. Diet, whey, with sanatogen, when apyrexia ensued. Convalescence normal.

NOTE.—Owing to the laboratory being moved to Rawal Pindi, no cultivation of the bacillus from the blood could be attempted.

A CASE OF ENTERIC FEVER IN A NATIVE OF INDIA. PERFORATION. DEATH.

BY LIEUTENANT G. S. WALLACE.
Royal Army Medical Corps.

No. 1357 Gunner Polo, No. 2 Company, Ceylon and Mauritius Battery, R.G.A., was admitted to the Native Military Hospital, Port Louis, on September 12th, 1906, complaining of "fever" of six days' duration.

The patient was a Hindoo, aged 20, born in Sohongra, Hoshiarpur, where he had lived and wrought as a cultivator until August 2nd, 1905, when, along with some friends from the same village, he went to Jullundur to enlist in the Ceylon and Mauritius Battery, R.G.A., being medically examined for this corps on August 5th. He then went to Colombo and remained there until October 28th, 1905, when he sailed for Mauritius, arriving in Port Louis on November 7th. Up till the date of his arrival in Mauritius he had suffered from no serious illness. Since his arrival here he has been under my care for ague, being eight days in hospital with his first attack, and nine days with his second. Since June, 1906, he has been taking prophylactic doses of quinine.

On admission his temperature was 102·2° F., pulse 96 per minute. His tongue was moist and coated with white fur. The bowels were constipated, although he complained that for some days before admission he had suffered from slight diarrhœa. The abdomen was not distended. There was no pain or tenderness in the right iliac region. The spleen was much enlarged.

On the morning of the 13th he was given a dose of mist. alba, and in the evening, his temperature having fallen to 99° F., he was given a subcutaneous injection of quinine bisulphate, grs. v.

On the 14th his temperature had again risen to 101° F., and on the same evening it was 102° F.

On the 16th his stools first attracted attention. They were fluid,

large, of a greenish-yellow colour, and had a very disagreeable odour. Widal's reaction carried out on this date gave a positive result with a dilution of 1 in 50. The patient's general condition had changed little since admission, but he now complained of headache and seemed rather stupid. The stools now numbered four or five per diem.

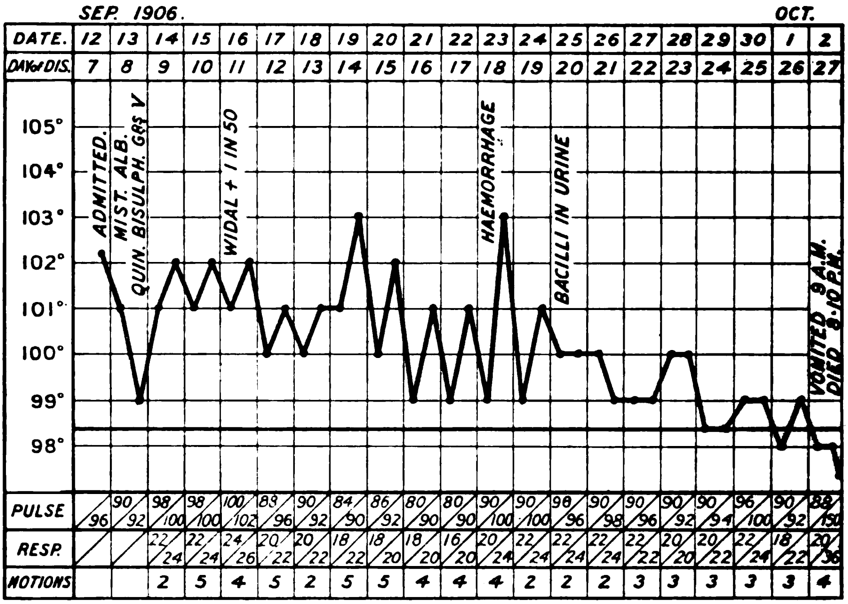
There was nothing unusual in the progress of the case until the morning of September 23rd, when he had a slight hæmorrhage, a quantity of dark blood appearing in one stool only. His temperature on the evening of the same day rose to 103° F., a height that had only once before been reached during his stay in hospital. From this time on the temperature gradually declined, and the number of stools passed per diem became fewer. The general condition did not improve. The patient was slightly delirious at night-time, and during the day was dull and stupid. His tongue was dry and covered with a brown fur. There were sordes on his lips and gums. The abdomen was slightly distended, and gurgling could be felt in the right iliac region. No pain or tenderness on pressure was complained of in this area. He also suffered from bronchitis.

On October 1st he seemed much better. His temperature on that day ranged from 98° F. in the morning to 99° F. in the evening, while his pulse was 90 to 92 per minute and of good quality. He also looked more intelligent and answered questions readily.

On the morning of October 2nd, when I was present in the ward, he vomited once. The vomit consisted of clear bile-stained fluid. For the rest of the morning he seemed quite comfortable, but late in the afternoon he became restless and complained of abdominal pain. I saw him at 4.30 p.m.; he was then lying on his back with his knees drawn up. His face bore an anxious expression, and it was difficult to rouse him. His pulse was about 150 per minute, small and wiry. The respirations were shallow and noisy, about 36 per minute. The temperature was 99·8° F. The abdomen was much distended. The percussion note was tympanitic all over the abdomen, and the liver dulness was quite obscured. Lieutenant-Colonel Spencer, I.M.S., saw him with me at this time, and the question of operation was discussed. It was decided that, in the absence of an operating room and good light, this would not improve his chances of recovery. He rapidly got worse and died the same evening.

Post Mortem.—A partial examination of the abdomen was allowed. The abdominal cavity contained about two pints of clear fluid. Small flakes of lymph were found on the intestines, which were much congested, especially the ileum and lower half of the jejunum. The ileum was perforated about 9 inches from the ileo-cæcal valve, the perforation being large enough to admit a good-sized quill. At the edge of the perforation there was a small bead of fæcal matter. Typical ulcers were found in large numbers in the lower part of the jejunum and the whole length of the ileum. The spleen was much enlarged and very

soft. A culture of typhoid bacilli was obtained from the spleen. Typhoid bacilli were also cultivated from the urine, withdrawn by catheter under aseptic precautions on September 25th. Cultures from the urine made previous to this date were sterile.



This case serves to show how typical enteric fever can be in a native of India. It is also interesting as being only the second admission for enteric to this hospital since January, 1900. The total admissions during this period have been 7,238, of which 4,922 have been cases of malarial fever.

CASE OF GUNSHOT WOUND CAUSED BY A BLANK CARTRIDGE.

By Major I. MacCARTHY.

Royal Army Medical Corps.

The following case is not one of any special surgical interest, and my only reason for submitting an account of it is to show what amount of injury may be inflicted by a blank cartridge.

Bombardier J., 71st Battery, R.F.A., at manœuvres on May 31st, 1906, was fired at by one of the "enemy," the muzzle of the rifle being, he stated, in direct contact with him. A clean, circular hole, about a third of an inch in diameter, was made in his service-dress jacket, his

shirt and his under-vest, and a wound about one and a half inches in depth in the fleshy part of his left shoulder. His clothes at the site of the hole must have been burnt up, as there were no fragments of clothing in the wound, which was dressed daily and was healed in thirty days. It is obvious what serious injury might have been inflicted if the rifle had been fired over a more important region, such as the face.

TREATMENT OF SYPHILIS BY INTRAVENOUS INJECTION.

By Major S. MACDONALD.
Royal Army Medical Corps.

The incidence, prophylaxis, and treatment of venereal disease possesses a perennial interest for all Army medical officers. When we consider that a few years ago the admission rate in India reached the appalling figure of over 500 per 1,000, and that it is still enormously high, it is no exaggeration to say that anything which may even in small measure tend to diminish this inefficiency is of the highest importance. From time to time efforts have been made to remedy matters, often in face of adverse influences, apathy, scepticism, and the like, and of late years a general awakening, a "revival," so to speak, has been in evidence, a determination to stamp out, or at any rate greatly diminish, this scourge, which is at once a disgrace to our Army, a slur upon the professional capacity of its medical officers, and a danger to the country at large. I venture to think, therefore, that the following notes of personal experience of the treatment of syphilis by the intravenous injection of mercury, done some time ago in India, may not only prove of interest to readers of the Journal, but encourage others to give a further and more extended trial to this method.

Baccelli, in Italy, in 1893, was the first to describe this treatment, and subsequently, in 1896, Mr. Ernest Lane read a paper on the subject before the International Congress of Dermatology in London. He wrote so favourably on the method that I determined to try it on the first opportunity. The *modus operandi* was that recommended by Mr. Ernest Lane, and is as follows:—

A 1 per cent. solution of cyanide of mercury is used, and 10 to 40 minims, according to the severity of the case, is injected into one of the superficial veins at the bend of the elbow, usually the median basilic, the vein being rendered prominent by a bandage applied round the arm. Strict antiseptic precautions are, of course, essential; the syringe should be thoroughly sterilised, the needles must be very fine and sharp, and air rigidly excluded. The syringe having been filled with the solution, the needle is entered obliquely into the distended vein, the bandage removed, and the contents slowly injected. If the needles are fine and skilfully introduced there is little or no pain, but if the vein is missed and the

solution forced into the surrounding tissue, considerable discomfort and irritation follow. With a very little practice, however, one very soon learns to penetrate the vessel properly, and the feeling of the needle moving freely in its lumen, as described by Mr. Lane, is very characteristic. If the veins are small and the needle introduced too perpendicularly, the result may be complete transfixation and injection of the solution into the tissues posteriorly. A few other points of difficulty that may be met with in injection are: obscuration of the veins when the skin is thick and dark coloured, tattooing, abnormal smallness of superficial veins, &c.

In no case did I observe the slightest sign of phlebitis, but on one or two occasions, when the vein was missed, there was temporary local swelling and discolouration, while in another an abscess followed, due probably to want of antiseptic precautions. In the majority of cases I used 20 minims injected daily until active manifestations had disappeared, and thereafter the same dose was given bi-weekly, and subsequently weekly.

In 50 cases I gave altogether 1,600 injections, the greatest number in any one case being 80, nearly all of which were made into the *same vein* at the *same site*.

The results in the 50 cases were as follows: 36 were very satisfactory, 3 were improved, 2 were invalided, and in 9 treatment was suspended.

Of these 36 cases returned *very satisfactory*, almost all had no signs of syphilis when examined some months after commencement of the treatment, were performing all military duties and attending weekly or fortnightly for injection. In the 3 cases shown *improved* all skin eruptions had disappeared, but some trouble was experienced in getting rid of obstinate throat lesions. Of the 2 cases *invalided*, one was for debility after all syphilitic manifestations had gone, and the other having suffered from repeated relapses, change to England was considered necessary. Of the 9 cases in which *treatment was suspended*, 4 were for difficulty in finding superficial veins, in 2 treatment seemed to have no effect, in 1 the veins, although prominent and superficial, were tortuous, with numerous valves rendering injection difficult, 1 contracted dysentery, and 1 malarial fever.

Although I have only given the results in 50 cases, I may add that I have treated many more by this method with excellent results, but no detailed notes were kept.

The *advantages* of the intravenous method are, I think:—

It is almost painless; the dose can be easily regulated; the absorption is certain; the therapeutic effect is obtained with the greatest possible rapidity, a point of some value when dealing with syphilis of important organs, or unsightly syphilides of the face; the digestive system is not interfered with; it is specially suitable for outdoor practice; it is often successful when other methods fail.

The *disadvantages* are stated to be the risk of phlebitis, thrombosis and embolism. I have never met with any of these in the cases I have done. A certain number of patients, however, object to this method on account of the supposed risk and pain. The main drawback I experienced was the difficulty in sometimes finding superficial veins.

While convinced of the efficiency of this method of treating syphilis, I do not recommend it as a routine one. I think it is specially valuable in those cases of obstinate skin eruptions, notably so in disfiguring syphilides of the face, which it is desirable to get rid of quickly. In those chronic cases of ulceration of the tonsils and fauces the results were somewhat disappointing, and sometimes negative until potassium iodide was freely administered.

These cases were treated in India in the plains, during the hot weather, under unfavourable climatic conditions. In a better environment—climatic, hygienic, dietetic—there is every reason to believe that the results would be more favourable. I would submit, however, that they are sufficiently encouraging to warrant a more extended trial, for it seems clear enough, *ceteris paribus*, that the direct introduction of the specific remedy into the circulation possesses certain inherent advantages.

A CASE OF EARLY GRAVES' DISEASE WITH APHONIA.

By Lieutenant CUTHBERT BROWNE.
Royal Army Medical Corps.

This patient, aged 20, was admitted to the Queen Alexandra Military Hospital, Millbank, on March 22nd, 1906, suffering from aphonia. He stated that, after feeling hoarse for some days, he suddenly lost his voice while on sentry duty three nights previously.

On admission he was found to be unable to speak above a whisper, he phonated slightly on coughing, and on laryngoscopic examination bilateral adductor paralysis was present; he presented no other abnormal physical sign. Three weeks after admission he found his neck was getting larger, and on examination slight enlargement of the thyroid gland was noticed; about this time he began to get out of breath on exertion. His condition on August 1st was as follows: Still unable to speak above a whisper, uniform enlargement of the thyroid gland, which felt soft and was difficult to define accurately. He had a fine tremor of both hands, and stated that he frequently felt very hot but was unable to perspire. There were no abnormal ocular signs or symptoms; no cardiac bruit.

From July 25th to August 6th his morning and evening pulse rates varied from 112 to 72, the average morning and evening rates both being 88; on running the length of the ward his pulse rate rose to 130. During this period patient had a variety of treatment, chiefly directed towards curing his aphonia, *e.g.*, high frequency for nine weeks, galvanism,

faradism, inhalations, blisters, painting neck with iodine, and nauseating draughts. His previous and family histories were good; he had spent all his life in Northamptonshire. At another laryngoscopic examination, made on August 3rd, the right cord moved slightly towards the middle line on patient attempting phonation.

On August 7th, patient's condition being as above, I operated, and divided the thyroid isthmus between ligatures. Patient took chloroform without difficulty, but he had great congestion of the veins, especially the inferior thyroids and a median anterior jugular which crossed directly over the isthmus. The gland was uniformly enlarged, somewhat lobulated in outline, the isthmus being greatly thickened, very short, and encroached upon by the lateral lobes, the latter nearly meeting in the middle line; these were freed from the sides of the trachea. The wound ran an uneventful course and healed by first intention. The patient did not speak either going under or coming round from the anæsthetic; on the evening of the operation he was still whispering; the next morning he stated his voice "felt stronger," and that evening, thirty hours after the operation, he spoke for the first time. His voice has remained normal since.

Average pulse-rate during fortnight following operation (patient got up on seventh day) was as follows: Morning 73, evening 76.

The interesting points in this case are the onset of the aphonia nearly four weeks before the appearance of the thyroid swelling, the return of the voice thirty hours after the operation, and the relief of his tachycardia. Though it seems probable that the aphonia must have been functional, yet it resisted strongly antineurotic treatment, and if purely functional one would have expected the appearance of phonation under the anæsthetic, or at least on regaining consciousness. With regard to the justifiability of the operation I think the relief of the tachycardia is sufficient answer, and although it is a possibility that the aphonia might have been cured by a mere skin incision over the gland, it is also a possibility that the pressure of the enlarged gland on the recurrent laryngeal nerves reflexly inhibited their adductor fibres, and so produced a functional paralysis. The relief of pressure after the operation put an end to this reflex inhibition, and the nerves took thirty hours to recover their normal functions. I do not think there is any question of malingering in the case; he was only too anxious to get well, understood that the operation was a severe one, and is extremely grateful for all that has been done for him. It would be interesting to hear of any similar cases.

I am indebted to Brigade-Surgeon-Lieutenant-Colonel C. E. Harrison, Grenadier Guards, for permission to publish this case.

REPORT OF A CASE OF TOTAL EXTIRPATION OF THE PENIS, WITH CASTRATION.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

Private M., aged 33, service fourteen years, was admitted to the Military Hospital, Colchester, on February 10th, 1906, suffering from a cauliflower-shaped growth which involved the penis in its whole extent as far as the symphysis, and had extended to the scrotum. He stated that it began about two and a-half years ago as a small warty growth on the glans. His medical history sheet bears the following entry in May, 1904: "Squamous papilloma—cause unknown—no gonorrhœa—local." He was acting as groom to his commanding officer, and in this way he had escaped all parades and duties which would have compelled him to have reported sick much earlier than he did. The growth was very painful, bled easily, and was very offensive. He was much emaciated and very cachectic in appearance. The inguinal and femoral glands on both sides were a good deal enlarged, but the skin over them was free. A portion of the margin was excised and sent up to the Royal Army Medical College for examination. It was reported epithelioma. Under the influence of six hours' continuous bath daily, the glands became much smaller.

On February 19th, 1906, he was anæsthetised with A.C.E., the growth freely swabbed with pure carbolic acid, and wrapped in wet lint. An incision was then made from the right anterior superior spine, along Poupart's ligament to the crest of the pubes. The skin was reflected upwards and downwards and the whole of the inguinal glands and the surrounding connective tissue removed in one piece. The incision was then extended down the thigh, and the whole of the femoral glands and connective tissue removed. The sheath of the femoral vessels was freely exposed and the crural canal emptied. The spermatic cord was transfixed at the external abdominal ring, and the cord tied with kangaroo tendon and divided. The skin incisions were rapidly sutured with continuous silkworm gut sutures, and drainage tubes inserted. A similar procedure was carried out on the opposite side. The inner ends of the incisions were then connected by one which curved upwards onto the abdomen, and the whole of the connective tissue over the symphysis removed down to the suspensory ligament. The patient having now been placed in the lithotomy position, a curved incision was made through healthy scrotum on each side and the testes torn out. The corpus spongiosum was then dissected out and cut across well behind the growth, but in front of the triangular ligament. The suspensory ligament was then cut through with scissors, working from above, and both cruræ divided close to the rami of the ischium. They were not invaded at this point. The scrotal tissues were thoroughly washed with 1 in 1,000 perchloride solution and

a flap brought up and sutured to the cut edge of the skin over the upper part of the symphysis. The urethra was split and sutured in the posterior angle of the wound about 1 inch in front of the anus.

The operation lasted one hour and three-quarters and there was no shock.

Twenty-five minims of liq. strychnia were given in divided doses during the operation hypodermically, and a hot saline and brandy enema of 2 pints at the end. There was some suppuration, but under the action of continuous hot baths the wounds rapidly cleaned, and by the middle of April they were practically healed. He was discharged to duty on May 7th, 1906, and has resumed his former occupation of groom. He reports at intervals for examination, and so far there is no sign of local recurrence. He has become very fat, and states that by pressing his finger forwards behind the urethra he can urinate standing.

Travel.

WITH THE BRITISH MEDICAL ASSOCIATION TO TORONTO—AND AFTER.

By Colonel J. M. BEAMISH.
Royal Army Medical Corps (R.).

(*Continued from page* 81).

September 12th, 1906.—Chicago, reached over night from St. Paul, in the noise and restlessness of its streets, is typical of the business activity of the leading cities of America. A cursory visit to one of the large warehouses—that of Marshall Field and Co., a general store—left the impression that even cheap wares were of remarkably good quality. The streets, handsome as a rule, are marred by being badly paved, and in some instances disfigured by elevator railways obstructing light and air. The post office, with dome and marble interior, is a conspicuous object in the centre of the city, and the public library, of ornate design, overlooks Jackson Park on the east side fronting Lake Michigan. The museum stands within the park, which has a length of a mile on the eastern boundary of the city, and is receiving an addition through made ground in the direction of the lake.

A visit to the famed stock yards and premises of one of the principal firms in the meat-packing trade, and an inspection in detail of the various processes employed in connection with the

slaughter of animals, tend to show that the late disquieting rumours, if not entirely unfounded, are probably exaggerated. The actual slaughtering is carried out in the most expert manner, and the carcases of hogs especially were those of animals well fed and dealt with from first to last in the most cleanly fashion. The floors were scrupulously clean, and the freezing room a model of neatness and order. It is true the slaughter of large cattle leaves a disagreeable and unsavoury impression, from the quantity of fluid which has to be dealt with, but the methods employed are inevitable, and such as are tolerated in all civilised countries.

Since January, 1900, the main drainage of Chicago has been diverted from Lake Michigan (which furnishes the water supply to the city) through the south branch of the Chicago river connecting with the Desplaines and Illinois rivers by means of a drainage canal 34 miles long, and thence with the Mississippi. By means of this canal and tributary rivers, therefore, the waters of Lake Michigan now flow into the Mississippi.

September 13th.—Chicago to Toronto.—The route lies through parts of Illinois, Indiana, Michigan and Ontario, and some of the most fertile and settled districts of Central North America in Illinois, well cultivated farms, chiefly of Indian corn and wheat, occupying more or less flat but well wooded country; in North Indiana, bordering on Michigan, a similar country, more fertile looking and more neatly farmed, with smiling fields of Indian corn, comfortable farm houses, and prosperous looking towns. Detroit, in Michigan, was passed at night, and is by all accounts an interesting city. At early morning Ontario was re-entered, where, as in other parts of the province, general farming was most evident. Toronto was reached at 8.30 a.m., eighteen hours from Chicago, and the circular tour to the far west was here completed.

September 13th-14th.—Toronto to Montreal by lake and river route.—During a stay of six hours at Toronto some belongings were picked up, and passage taken in the Richlieu and Ontario steamer, leaving 3.30 p.m. for Charlotte on the south shore of Lake Ontario, thence across the lake in another direction north-east to Kingston (5 p.m., 14th), where the tour of the Thousand Isles down stream was commenced and continued till 10.30 a.m., when a change of steamer took place at Prescott, with a view to negotiating the Lachine and other rapids later in the day. The isles are a series of rocky islands varying in size, wooded for the most part, and occupied by villas or châlets, largely owned by Americans. Several rapids, including one at Long Sault, with a drop of 48 feet in

9 miles, were passed during the day, but, owing to lateness of arrival, the steamer could not shoot the Lachine rapids, and in consequence the passengers were transferred, after dark, to a train which was in waiting at Lachine, and arrived at Montreal about 8 p.m.

September 15th-16th.—During a stay of two days at the Windsor Hotel, a survey was made of the principal objects of interest in the city—including Mount Royal, the most conspicuous, commanding an extensive view of the St. Lawrence valley, the Green Hills of Vermont bounding the horizon on the south-east and the lower lying parts of the city. It is a wooded hill, rather steep, but made accessible by a good road pursuing a zig-zag course to the summit, and adds much to the interest of the place. The most notable churches are the new Roman Catholic Cathedral in Dominion Square on the model of St. Peter's, the older church of Notre Dame in the lower part of the city, and the Anglican Cathedral, a Gothic edifice in St. Katherine Street, skirting the base of Mount Royal. McGill College stands in ornamental grounds within the city, and is well known as a most flourishing institution.

Montreal has a present population of 360,000, mostly French speaking, and is the largest city in Canada; its population of French descent are largely employed in the lumber trade. It also possesses much antiquarian interest, sharing with Quebec the honour due to such pioneers of European civilisation as Jaques Cartier and Champlain, and retaining up to modern times that pre-eminence in trade and commerce which has distinguished it from its foundation by the French, in the early part of the seventeenth century. Both here and at Vancouver it was my good fortune to witness a first class game of lacrosse—the national game of Canada—between local teams. Cricket is not much in vogue at any time, but football and hockey are popular during the late autumn and spring months.

September 17th.—Montreal to New York.—This is a one day trip, and of its kind, among the best in America. The twelve hours' journey, 7.30 a.m. to 7.30 p.m., may be completed *via* the Delaware and Hudson direct, or interrupted by a side trip through Lake George, between certain points on the railway. The St. Lawrence is first crossed by a fine bridge on the Grand Trunk system, and for some miles the country is flat and uninteresting, till, somewhere near the international boundary, north of Rouses Point, a few small lakes appear eastward with a distant view of the Hills of Vermont, and the Adirondacks outlined on the south-west. The approach to the latter, about two or three hours from Montreal, lies through

some low wooded hills. Lake Champlain appears on the east, and with its expansions and inlets is visible a great part of the way to Albany. The Adirondacks on the west here rise to a height of 4,000 to 5,000 feet, finely wooded and diversified by valleys and hill tops for many miles in the same direction. Saratoga, where one of the decisive battles of the war of Independence was fought, is passed some distance north of Albany. Glimpses of the Hudson are obtained as Albany is approached, and the river is crossed immediately below the town. The railway follows close to the left, or east bank, of the river, the whole way to New York, the Catskill mountains (4,000 feet) appearing westward at some distance from the river valley, about half way between Albany and New York. The Hudson is a somewhat sluggish stream, from 200 to 500 yards wide in its main course, flowing between wooded banks, and dotted with small islands at intervals. Its setting of mountains in the background lends it a peculiar charm, especially at sunset; night fell about three-quarters of an hour from New York, which was reached at 8.15 p.m., half an hour or more after due time.

September 18th-19th.—New York.—The weather conditions of New York, 82° F. in the shade, the third week in September, were not such as to encourage sight-seeing, though facilities were numerous. However, a beginning was made at Brooklyn Bridge, easily reached from the Manhattan Hotel and great central station by a subway. From a seat in a tram-car, while crossing the bridge, a good view is obtained of the sky-scrapers on and near Broadway, but the onward journey through the overgrown suburb of Brooklyn, for a distance of several miles, leaves no more interesting impression than an aggregation of streets, darkened frequently by an elevator railway. On another occasion the Central Park was visited, with a more satisfactory result, in that it is tastefully laid out, but not otherwise noteworthy in respect of its size or surroundings. The public library, on the site of an old reservoir in 42nd Street, remains in an unfinished state, after the lapse of more than seven years. The great extent of the wharves and spaciousness of the harbour are more striking, but most of all the marvellous business activity of the city—the eagerness of its crowds, the splendour of its buildings, the perfection of its railroad and car systems, and the supreme consciousness of its people of the value of time. "No loitering" is here largely writ in action as well as in words.

As I had not an opportunity of visiting the art galleries during the two days at my disposal, I may just refer to a striking allegorical fresco—"The Triumph of Manhattan"—decorating the

panels of the vestibule of the Manhattan hotel—one of the best in the city. It is the work of H. K. Turner, I understood, figuring on the right the entry of the Dutch—(A.D. 1614)—the original settlers of Manhattan or New Amsterdam, afterwards New York—followed by their successors, the English, to the central figure of America, which, in the garb of a female seated on a throne, receives a deputation of Indian chiefs on the left. The fresco is reminiscent of the style of the late Burns-Jones, and aptly compares with a kindred work of art which adorns the hall of the new courts of justice at the Old Bailey.

Coney Island, also visited, is a seaside resort within easy reach of New York, rounding off the southern end of Long Island. The season there was just over. It possesses a sandy beach with numerous bathing establishments, and also a street plentifully furnished with booths to attract holiday makers. There is also a good racecourse at Gravesend close by, which answers to Longchamps nearer home.

September 20th-24th.—New England States and Boston.—The journeys from New York to Boston and *vice versâ* (five to six hours' rail each way) were made by different routes, in the former case by Newhaven and Hartford, the state town of Connecticut, and on the return journey by the coast route, through Providence, state town of Rhode Island, New London (also on Thames), again through Newhaven and Bridgeport to New York. The Connecticut river, between New London and Newhaven, is crossed near its mouth.

The general character of the country, as above, comprising the three southern states of New England, does not vary much as seen from the railway, being hilly and extensively forested with small timber as a rule; birch, maple, poplar, oak and pine, to a lesser extent. The land is of poor quality, often stony, and the farms are of limited extent for the most part. The towns, however, engaged in trade of various kinds, have a prosperous appearance. Hartford has some saw mills, but the quality of the timber in the surrounding country does not admit of a flourishing lumber trade. Providence has a showy state house of marble, in the Italian style, with a dome resembling St. Paul's, and in fact, many of the public, and especially State, buildings in America are copies of this original.

Boston is perhaps the most interesting city in America from the historic point of view. Founded early in the history of American colonisation—A.D. 1627—by a band of settlers under

Winthrop, with a special charter from the Crown, securing exclusive rights to the port in Massachusetts Bay, it progressed from its original settlement at Charlestown, through the colonial and provincial stages, up to the revolutionary period, when, as is well known, it took a principal part in the movement which led to American independence.

The colony at an early period (A.D. 1635) founded its university at Harvard; and doubtless the numerous gifted alumni, clerical and other, of such a centre of culture, distributed throughout the province as well as Boston itself, from the earliest to later times, were largely the means of keeping alive that spirit of inquiry, and even dissent, which, at an early period, involved the colony in disputes with the Mother Country, and locally became the fruitful source of civic and religious strife. The same spirit gave impetus to that galaxy of talent familiar to our own times, and only extinguished late in the nineteenth century, represented by such names as Lowell, Emerson, Longfellow and Oliver Wendell Holmes. Nor do the lights of Harvard grow dim in the twentieth century, for do we not see younger Cambridge, though not young at the mature age of 270 years, competing with her elder sister for aquatic supremacy in our own waters?

It was my privilege to see recently the new Harvard Medical School just opened, which, for the completeness of its laboratories and lecture rooms, and handsome, if somewhat severe looking, exterior of marble, would compare favourably with most institutions of the kind in the world. Boston, in characteristic fashion, at present also harbours Christian science; but the *genus loci* may be trusted to improve away all such manifestations of error.

A subway from the central point of the city at the base of Tremont Hill, its highest point, connected, at a wharf on Atlantic avenue, with a submarine tunnel between East and West Boston, is considered a triumph of engineering skill. The trade of the city is considerable, the port being second only to New York, and the warehouses in the business streets are noticeable, as well from their numbers as from their palatial size and architectural elegance. The State House, in brick and marble, with gilded dome, is a conspicuous object on Tremont Hill, and contains, besides the Chamber of Representatives, the usual offices of the several departments of State. The entrance hall, staircase, and upper corridors are adorned with portraits of former governors and other notables.

The public library, completed less than twenty years ago, is

worthy of Boston. It is a rectangular, three-storied building, fronting an open space, having the pilasters of the outer walls inscribed with the names of all known authors, past and present, in poetry, history, music and fiction, of all nationalities. There is a fine collection of old editions of the English Bible and Prayer Book, and the State House also, it may be added, has the Royal Arms of England emblazoned on a memorial window for successive reigns up to and including that of George II.

The monument on Bunker's Hill, Charlestown, a massive quadrangular obelisk, 221 feet high, commemorating the final success of the revolutionary movement, as well as one near the State House recording the famous tea dispute of 1773, and a third mural tablet to the memory of the black troops who fell in the late civil war should not pass unnoticed. The King's Chapel, centrally situated in a disused graveyard, and the oldest church in Boston, is now Unitarian; others are the Presbyterian, an old church; Trinity, Episcopalian, a new church, facing the library, and the Christian Science Memorial Building. There is also a large Roman Catholic church. The Touraine Hotel, possessing an excellent library, is the best in Boston.

Two of the seaside resorts a few miles north of Boston were visited—at Revere Beach and Winthrop—the latter not far from East Boston, and the former in the same direction further north. Both are well supplied with restaurants and residential villas, and have promenades a mile or so long, with sandy beaches fronting the Atlantic. The season had just closed at Revere Beach, but Winthrop, on a fine Sunday, was gay with pedestrians and some carriages, without the usual vulgar and noisy accompaniments of such places.

Atlantic Voyage.—Though the weather had improved, time did not admit of a further exploration on return to New York, September 24th, as my passage was booked in the new Cunard turbine s.s. "Carmania" (20,000 tons), timed to sail for Liverpool on the 25th. The ship carried barely half her complement of first-class passengers, and this fact, conjoined with elegance of the reception and state rooms, unexceptional *cuisine*, good attendance, perfect conditions of sea and weather, with a day temperature almost always within the sixties, while crossing the Atlantic in the newest turbine steamer, made the passage home one of the most delightful that can be conceived in ocean travel.

September 25th to October 3rd.—For two days after leaving Sandy Hook the sea was smooth and sky unclouded. A slight fog came

up early in the morning south of Newfoundland, to clear again later in the day. Light winds and a moderate sea succeeded in the east Atlantic, till the coast of Ireland, invisible through fog, was reached. Kinsale Head was the first conspicuous object met with, and Daunt's Rock was passed soon after midday, October 2nd. Queenstown Harbour was entered soon after to land passengers and mails, and Liverpool reached the following morning. Disembarkation took place about 9 a.m., and the special train in readiness, leaving about 10.15 a.m., arrived at Euston at 2 p.m., October 3rd.

The average daily run for nearly seven days between Sandy Hook and Daunt's Rock was 401 miles. So ended the trip. It may be added that the "Carmania" was in Marconi communication with Sable Island in the West Atlantic, south of Newfoundland, and with Crookhaven towards the end of the voyage.

Addenda.

(1) *Climatology.*—Given the route described to be traversed, viz: 6,000 miles both ways across the Atlantic, and 8,000 miles to and fro across Canada and the United States, no better time could, on the whole, be selected for a trip, than that coinciding with the visit of the British Medical Association to Toronto, and subsequent excursions to the far west. The weather on the outward bound voyage *viâ* the northerly Canadian route was generally fine, and the temperature almost always within the sixties during the mid-hours of the day, and not much below at night. For a day or so near Newfoundland the weather was foggy, or overcast, and colder, but changed to fine again with increasing warmth in the Gulf of St. Lawrence, and up to Quebec, where some unpleasantly hot weather had been felt the previous week. Ottawa was hot but dry, 88-94° F., and Toronto at first hot and moist, from proximity to the great lakes, but changed to cooler weather after some rain, which fell about the middle of the week (August 23rd). The onward trip by the lake route was only marred by some over-crowding on the steamer. The great lakes were crossed in bright moonlight and under good weather conditions on the whole, though some rain fell, and a perceptible change to colder weather was felt about Lake Superior. There was a hoar frost *en route* to Winnipeg, August 30th to 31st; but the two succeeding days, through Manitoba and Saskatchewan, and up to the Rockies, were perfect from a climatic point of view. At no time after entering British Columbia, even at the highest of the passes, except perhaps at Glacier House and Selkirk summit (4,300 feet), about 6 to 7 p.m.,

when it was a little cold, was the climate other than equable and pleasant, increasingly so, of course, as the Fraser Cañyon and sea coast at Vancouver were approached. Heavy rain fell at Victoria and Vancouver on September 5th and 6th, but neither cold nor heat has to be reckoned with in such a temperate climate. A dense vapour obscured the atmosphere round Vancouver, and even Victoria, due to forest fires on the mainland. A gorgeous sunset was observed on the return journey near Moosejaw in West Canada, in which varying shades of purple and gold were heightened in effect by a double rainbow. Toronto, on the return trip, September 13th, had not quite abandoned its summer, but Montreal, 14th-16th, had perfect weather. New York, September 17th to 20th, and even later, was very hot and oppressive at 82° F., Boston 5° cooler 20th to 23rd, but on the eve of sailing (24th) New York had improved considerably.

The ocean voyage to Queenstown was, I suppose, phenomenal, scarcely a movement in the ship or a cloud to be seen in the early part of the voyage, till a fog enveloped the south-west coast of Ireland. The channel passage was also very good and Liverpool reached in good time. Both ships, the Canadian Pacific "Empress of Britain," and Cunard s.s. "Carmania," each of 20,000 tons, were almost new, and splendidly appointed.

(2) *Aborigines.*—The origin of the natives of North America still remains a puzzle to ethnologists. There is, however, a general consensus of opinion that the aborigines, North and South, are derived from a common stock, and that the various tribes, numbering many hundreds, to be seen at the present day, owe their divergencies to special environment in the course of ages, and perhaps some admixture with inhabitants of the old world, including the Pacific islands. There is a type of American Indian pointing to a Mongolian stock, with flatter features and a more prognathous mouth, than are seen in the more accepted type, in which the nose is straight or slightly aquiline. It has also been observed that at least some American Indians use implements of almost the exact pattern of those used by Pacific islanders, even so far south as New Zealand. While these facts are noticeable, some common features pervade the whole race, in their small and imperfect cranial development, with receding forehead, thin beard, straight black hair, persistent in colour and round on transverse section, and red or copper-coloured skin. These peculiarities, and especially the character of the hair, conjoined to the polysynthetic nature of the language, which it is not necessary here to discuss,

point to a primordial unity of origin, and an independent development of the race on the American continent.

In Canada certain reservations of land are apportioned to the native Indians, and, in the case of riverain tribes, they are allowed to encamp almost anywhere within sixty-six feet of the shore. By universal assent their numbers are fast diminishing—crowded out in the first place, and in the next, decimated by disease, chiefly tuberculous. With what truth may be doubted, but I have heard overcrowding, induced by a too general use of the stove—a European importation—assigned as a cause of this disease among Indians. Certain it is that a like cause, namely, overcrowding, has operated prejudicially in the case of the Maories in New Zealand. The laws are stringent, forbidding the supply of intoxicating liquors to natives.

(3) *Education.*—Canada has an excellent educational system, and appears to have solved the educational problem in a most sensible and practical manner. The schools are undenominational with facilities, except in the province of Quebec, where the system is denominational, as might be expected. The standard is reported to be high, and provision is made for a thorough diffusion of the benefits of education, in the existence of a law that, where seven children of school ages can be counted, the local authority is compelled to build and maintain a school for their benefit. The success of the educational system in Canada is doubtless in great measure traceable to the willing co-operation between members of the several denominations for the common good in such an important matter as education.

(4) *Missions.*—These are established in most stations, however remote, and, where opportunity offers, the native Indians appear also to be successfully approached. On Sundays a cleric may be seen taking advantage of a freight train to hold a service in a remote district, and facilities for this purpose are given by the railway companies. Mutual benefit seems to be a leading motive for such privileges, inasmuch as pioneering is, on the whole, most likely to be successful where mission stations are established.

(5) *United States Police.*—These are a smart looking and intelligent body of men. Above average height, they are dressed in blue cloth, with a plain frock, long and loosely cut, and white helmet. Blue uniform of the same pattern, but lighter in colour and texture, is worn in summer, especially at the seaside. The dress appears to be uniform throughout the States, and, if one may particularise New York, the appearance of the force is everywhere most credit-

able. They, as well as cab-drivers and hotel servants, male and female, are mostly Irish.

(6) *Cemeteries*, throughout America, have some peculiarities. The monuments generally are of the reformation type—monoliths with or without a crowning urn, or simple grave stones replacing, except in special localities, the older symbols of Christian burial. Stone walls are rare, and the wood and wire fences taking their place give an unkempt appearance to the enclosures.

Woodlawn cemetery, outside New York, seen from the railway *en route* to Boston, furnishes an exception to the rule in its generally neat and secure appearance. It has handsome monuments, of the common type, however, with frontages occasionally on a slope, resembling some in Père la Chaise.

General Remarks.—A casual acquaintance with the man in the street, and observation of English "as she is spoke" by the average wayfarer, are not reconcilable with current ideas in this country as to American speech and manner. Americanisms there are it is true, but what are understood as Yankee manner and nasal twang are now by no means so much in evidence as is generally supposed. Nor is the bodily figure of Uncle Sam very common, though a perfect type is occasionally met with everywhere. The explanation would appear to be that immigration is working a great change, and, by all accounts, the emigrants who now seek a home in the country are by no means of the most desirable class. At all events, if we consider the inhabitants of any of the principal cities, such as Boston, at the present day, they are divisible into four classes, as regards origin and residence. The largest group is composed of immigrants, next come their children, third residents born in some part of America, but not of local origin, and lastly the truly local inhabitants, a comparatively small group.

Now this classification, based on vital statistics, accounts for the comparative rarity of the American proper answering to the once accepted standard and type. The true American is being supplanted, and is in fact undergoing a decline both from this cause relatively, and more directly from another cause, operating also among some of our older civilisations, namely, race suicide.

Another fact borne in upon the visitor to Canada is the gradual Americanisation of the country. Apart from undisguised expressions of loyalty to the Mother Country, there is no gainsaying the fact that great proximity and intercourse along the border line, between Canada and the United States, especially in the lower provinces, are insensibly working an assimilation of thought and

interest, which are intensified by the new development of Canada, and recent immigration of the farming classes in considerable numbers from the United States. The latter also are welcomed from their superior knowledge of the country and western methods, not to mention importation of capital, which Canada wants. At the present time the habits of life, railway travelling and hotel accommodation are similar in the two countries, so that a person passes from one to the other without any very perceptible change in his surroundings.

A general sobriety was noticeable among Canadians, which, with their proved industrial habits, and the accession of a good class of immigrants, bodes well for the future of the Dominion.

NOTES ON SIERRA LEONE.

By Sergeant W. A. MUIRHEAD.
Royal Army Medical Corps.

Amongst the various ranks of our Corps little is known of this West African Colony, so that the following notes on Sierra Leone as a garrison may be of some interest, at any rate to intending West Coasters.

The voyage out occupies eleven or twelve days. Embarking at Liverpool on one of the Elder Dempster liners, which leave Princes Dock every Saturday, Las Palmas is reached in five days; here a short stay of five or six hours is usually made, and a pleasant afternoon can be spent visiting the Island. Conakry, the next port of call, is seen on the tenth day, and the morning of the following day the coast of Sierra Leone is within sight. While on the subject of the voyage out it is as well to mention that one's baggage should be insured, as the method of unshipping it at Freetown, by lighter, is far from safe; this I learned from personal experience.

The general appearance of the Colony, viewing it from the sea, is distinctly impressive and altogether different from one's preconceived ideas. A mountainous peninsula, about 26 miles long and 12 broad, standing out to sea from a perfectly flat coast-line, forms a striking feature. (This impression usually lasts from four to five days, to be renewed with pleasure when seen from the stern of an homeward bound steamer.) The whole face of the country is well wooded; large trees, low shrub and thick underwood, abound everywhere.

The climate, although far from being a desirable one, is not so bad as it is painted. From January till May it is hot and humid and one usually suffers from that "tired feeling." In May the rains commence and continue until November, ending with severe tornadoes. The Manhattan winds, hot and dry, then blow from the interior for a period of about six weeks. The synonym, "The white man's grave," does not hold good now. The high death-rate of the Colony was said to be caused chiefly by the changeable climate, but doubtless the wily mosquito has a lot to answer for.

Freetown, the capital, lies along the northern slope of the Sierra Leone mountains, facing the large natural harbour, said to be one of the finest on the African coast. Tower Hill, a mound rising 400 feet in the centre of the city, is the headquarters of the garrison. Mount Aureol and Wilberforce are other stations in the Colony. In the Protectorate troops are stationed at Port Lokkoh, Mabanta and Batkanu. Tower Hill garrison is composed of one European and two non-European companies of Royal Garrison Artillery; one company Royal Engineers; two companies West India Regiment, and detachments of Royal Army Medical Corps, Army Pay Corps and Army Ordnance Corps.

The hospital is situated some 200 feet up the northern slope of the hill. It is equipped for seventy-eight beds, two wards being set apart for Europeans. There are three medical officers doing duty at the hospital, and one as Sanitary Officer at the District Laboratory about 50 yards away. The Royal Army Medical Corps detachment consists of two non-commissioned officers, a compounder and a laboratory assistant, and one private, who is in charge of the European wards. There are also two corporals and seven men of the Fixed Hospital Establishment, West Indian soldiers, doing duty in the other wards. The sick from Murray Town, King Tom, Falcon Bridge and Farren Point batteries are treated at this hospital.

At Mount Aureol and Kortright are quartered the 1st Battalion West India Regiment. Mount Aureol is 800 feet high, and about 1½ miles to the East of Tower Hill; Kortright is a plateau 200 feet above it. The hospital is in an ideal situation, just below the barracks. It is equipped for sixty-four beds; there is also an officers' ward nearing completion. The staff is made up of two medical officers, one non-commissioned officer (compounder) and two privates, Royal Army Medical Corps, two corporals and four men of the Fixed Hospital Establishment.

Wilberforce, a plateau 900 feet high, and 3 miles to the west

of Freetown, is the headquarters of the West African Regiment, which is recruited locally. There is one medical officer in charge of the hospital, which is about ½ mile from the barracks. The staff consists of one non-commissioned officer and four men of the Fixed Hospital Establishment.

At Port Lokkoh, Mabanta and Batkanu, companies of the West African Regiment are stationed, one medical officer being in charge of each.

The chief diseases are malaria and blackwater fever; enteric fever is unknown here: possibly this is due to the pure water supply.

The Senior Medical Officer's quarters are at Tower Hill, but quarters for other medical officers are not always available. If there are no quarters vacant for a new arrival, a system of "doubling up" is in vogue. At Hill Station, ½ a mile beyond Wilberforce, are bungalows for senior officers and colonial officials. They are usually occupied by married officials, who bring out their wives during the dry season. There are no arrangements for the education of European children.

Native servants are easily obtained, but require a lot of training. They are paid from 20s. to 25s. per month.

Officers of the Royal Army Medical Corps receive double rates of pay, also hammock allowance at 3s. per day. Rebate is drawn at the following rates: Lieutenant-Colonel, 1s.; Major, 11d.; Captain 10d. and Lieutenant 9d. per day.

Extra pay is drawn by non-commissioned officers and men as follows:—

	Staff-Sergeant.	Sergeant.	Corporal.	Private.
Coast pay	1s. 9d.	1s. 6d.	1s. 3d. ..	6d. per day.
Colonial allowance..	1s.	1s.	6d. ..	6d. ,,
Rebate	1d.	1d.	½d. ..	½d. ,,

Khaki-drill uniform is generally worn on duty. Mufti, underwear, &c., should be brought out from home, as they are expensive here owing to the heavy import duty. A solar topee, mackintosh and gum boots are indispensable.

There is plenty of sport amongst the various corps in the garrison; football, cricket, hockey, golf, tennis and croquet, are played at different times of the year. Racquets, clubs, &c., should of course be brought from home. There is no opportunity for cycling or motoring; the roads are hilly, uneven and intersected with ditches. Horses do not thrive here, and are seldom seen. A hammock, slung on a framework, and "toted" on the heads of four natives, is the general mode of conveyance.

Two months' leave to England or the Canaries can be had during the year's tour. Many take advantage of this; others spend their leave in the Protectorate. The source of the River Niger can be reached in seven or eight days from the rail-head, where good shooting is always to be had, as bush-fowl, guinea-fowl, buck, &c., abound in the rice fields. During a trip I had in the bush, numerous leopard traps, set by natives, were seen, and although no leopards were noticed along the route traversed, I was assured that they were to be got, as evidenced by the skins in the villages, which are readily bought by traders. A great number of officers and men spend their leisure in butterfly catching; many valuable specimens are seen in the various collections.

Others add to their linguistic abilities, there being over forty different languages spoken throughout the Colony and Protectorate.

In conclusion, no description of Sierra Leone is complete without the "Coasters chorus," which runs:—

> Our time on the Coast is getting shorter every day.
> Four months' furlo', lodging allowance and pay.
> Some are getting six months,—others have to stay,
> But our time on the Coast is getting shorter every day.

Extracts, &c.

AN EPITOME OF THE MIDWIVES ACT, 1902.

By Captain R. J. BLACKHAM.
Royal Army Medical Corps.

The Midwives Act, 1902.

As one of the questions asked at the last examination for the Diploma of Public Health at Cambridge was "Epitomise the Midwives Act, 1902," and a similar question was asked at Oxford a year ago, it has occurred to me that, as this Act has not yet found its way into Hamer, Parkes and Kenwood, Whitelegge, or any of the other standard books, except Robertson and Porter's "Sanitary Law," the following epitome, which I prepared when reading for my D.P.H., might be of interest to readers of the Journal. Apart, however, from candidates for Diplomas in Public Health, the statute has special interest to those of us who are engaged in instructing or examining Army midwives, as some familiarity with the provisions of the Act is essential in order to appreciate the reason for the important amendments to the regulations for the training of Army midwives introduced by Army Order 178, dated October 1st, 1904. The

Midwives Act, 1902, is officially defined as being framed to secure "the better training of midwives, and to regulate their practice." It consists of eighteen sections, which may be briefly referred to *seriatim*.

Section I.—(1) From and after April 1st, 1905, any woman not certified under this Act who shall use the name of midwife either alone or in combination with any other word or words, or imply by any other title or description that she is a person specially qualified to practise midwifery, or recognised by law as a midwife, shall be liable on conviction to a fine not exceeding £5.

(2) From and after April 1st, 1910, no woman shall habitually and for gain attend women in childbirth otherwise than under the direction of a qualified medical practitioner, unless she be certified. Any uncertified woman so acting shall be liable to a penalty of £10, but the section shall not apply to any one acting in an emergency.

(3) No woman certified under this Act shall employ an unqualified substitute.

(4) Women certified under the Act must not assume any title or designation implying that they are medical practitioners or authorised to grant any medical certificate, or certificate of death or stillbirth, or to undertake cases of abnormality or disease in connection with parturition.

Section II. refers to registration of women between April 1st, 1903, and April 1st, 1905, and is no longer of interest.

Section III. gives to the Lord President of the Council power to form the Central Midwives' Board, which consists of nine persons, four being medical men, and the remainder nurses or lay persons. The four medical members represent the Royal Colleges, the Society of Apothecaries, and the Incorporated Midwives' Institute. The Royal British Nurses' Association, Queen Victoria's Jubilee Institute for Nurses, and the Association of County Councils, appoint one member each, and the Lord President appoints the two other members, one of whom must be a woman.

The duties and powers of the Board are:—

(1) To frame rules regulating the course of training, the conduct of examinations, the issue of certificates, the supervision and restrictions within due limits, of the practice of midwives, and the conditions under which midwives may be suspended from practice.

(2) To appoint examiners.

(3) To decide upon places where, and the times when, examinations shall be held.

(4) To publish a roll of certified midwives.

(5) To remove for misconduct the name of any woman from the roll, or to restore the name of any woman so removed.

(6) To issue and cancel certificates.

Rules are not valid till approved by the Privy Council.

Section IV. gives a woman aggrieved by any action of the Central Midwives' Board right of appeal to the High Court of Justice within three months of decision appealed against.

Section V. fixes fee for examination or registration at not more than a guinea, and deals with the disposal of money received in fees.

Section VI. enacts that there shall be a roll of midwives.

Section VII. provides for clerical duties of the Board, and makes the roll evidence in all Courts that women therein specified are certified under the Act.

Section VIII. makes County Councils and County Borough Councils local supervising authorities under the Act, and gives them powers to investigate charges of malpractice, negligence and misconduct, and also to suspend midwives from practice if necessary, to prevent spread of infection.

Section IX.—County Councils may delegate these powers to District Councils.

Section X.—Women, before commencing to practise in any area, must give notice in writing to the local supervising authority, and continue to give like notice during the month of January in each year thereafter. Every such notice must contain such particulars as will secure the identification of the person giving it, and omission to give notice, or making, or causing others to make, a false statement in such notice, is an offence under the Act punishable by a penalty of £5.

Section XI.—Any woman procuring, or attempting to secure a certificate by making, or causing to be made, a fraudulent declaration, certificate, or representation, either in writing or otherwise, shall be guilty of misdemeanour, and shall be liable to be imprisoned with or without hard labour for any term not exceeding twelve months.

Section XII.—Similarly any person wilfully making or causing to be made any falsification in any matter relating to the roll of midwives shall be guilty of a misdemeanour, and liable to a like term of imprisonment with or without hard labour.

Section XIII.—Any offence punishable under this Act may be prosecuted by the local supervising authority, and the expenses of the prosecution shall be a charge against the County or County Borough in which the prosecution takes place.

Section XIV.—Where a woman considers herself aggrieved by any ruling of a Court of Summary Jurisdiction (*i.e.*, Police Court or Court of Petty Sessions) she has right of appeal to Quarter Sessions.

Section XV. deals with method of defraying working expenses of the Act.

Section XVI. provides that nothing in the Act respecting the practice of midwifery shall apply to practitioners registered under the Medical Acts.

Section XVII. provides that the Act shall not extend to Scotland or Ireland.

Section XVIII. enacts, in conclusion, that the term "Midwife" means a woman certified under this Statute, and no other.

NOTES ON THE MILITARY POSITION OF OFFICERS OF THE ROYAL ARMY MEDICAL CORPS IN RELATION TO THEIR MEN.[1]

By Lieutenant-Colonel E. M. WILSON, C.B., C.M.G., D.S.O.
Royal Army Medical Corps (R. P.).

Gentlemen,—A year ago I was asked by your Secretary to read a paper for this Society, and I selected for my theme the "Duties and Responsibilities of Officers of the Corps with Regard to their Men." This was afterwards published in the Journal of the Royal Army Medical Corps, and I was surprised and flattered by the number of letters and kind messages which I received from brother officers, showing that the subject was considered by some, at any rate, as one of interest. When Colonel Powell, therefore, asked me again this year to contribute something for discussion, I wondered whether there was any way in which I could add to or amplify my former remarks without going over old ground, and I thought that, at any rate, I could try to put before you something which might be of interest without unduly taxing your patience.

We have again, as last year, a large class of young officers whose acquaintance with the Corps is of recent date, and if they think they are in for another lecture, in addition to the large number which they are compelled to attend on all sorts of subjects, I can only promise that it shall be a short one and not followed by any examination.

To the seniors, I may say that the year which is closing has been one of very considerable changes, so far as the rank and file are concerned, and perhaps some reference to these alterations may not be uninteresting.

I do not wish to recapitulate the remarks I made last year more than I can help. Those who care to look them up will find them in the January number of the Corps Journal for 1906, but I should like to draw the attention of all, and especially the juniors, to the unique advantage we possess over all other branches of the Army, in the fact that we are not only the officers but the "medical officers" of our own men. From his enlistment to his discharge, whenever a soldier changes his condition the change is almost invariably accompanied by a certificate that he is "medically fit." When he extends his service, re-engages, continues in the Service beyond twenty-one years, comes up for promotion to warrant rank, proceeds on foreign service, and so on, he comes before his officer in his capacity as a medical man. I wish all officers would realise what an opportunity this gives for knowing their men thoroughly and personally, and for selecting the best.

As regards recruits, as you know, the men must not only be physically

[1] A lecture delivered before the Aldershot Medical Military Society, December 3, 1906.

fit, but "suitable for the Royal Army Medical Corps;" and this point is so important that fresh instructions have lately been issued by the Director-General. I am afraid of wearying you, but I cannot refrain from pointing out that we are again in excess of our authorised establishment, and that, in all probability, we shall shortly have to stop recruiting altogether, so that each man now enlisted should be selected as likely to prove in all respects a desirable acquisition to the Corps. A man rejected for our Corps is not necessarily lost to the Army. He is available for enlistment into other branches, so I do not think the recruiting staff officer or recruiting sergeant have any reason to complain, or to bring pressure to bear on the medical officer, as is said sometimes to be the case. Consider particularly the men enlisted for one year with the colours and eleven in the reserve, how important it is that only intelligent men should be chosen, so that they may obtain full advantage from their year's training.

Again, as regards promotion, especially to the senior ranks, I do not recall any period during my service when we have had so large a number of thoroughly qualified non-commissioned officers and men *waiting* for vacancies to occur for advancement. Personally, I think that when a warrant or non-commissioned officer has obtained the pension to which he is entitled, it is for the benefit of the Service, except in very special cases, that room should be made for younger men. Yet, when the seniors are certified to be in all respects fit for continuance, it is hardly fair to throw the responsibility of refusing the request upon our office. We must accept the medical certificates of officers who are in the best position for knowing the physical capabilities of their own men.

I need not refer to foreign service, for obviously no one would certify a man as fit for a tour abroad who was likely to be shortly invalided, to the detriment of his health and expense to the public; but we have special appointments, such as those at Sierra Leone and under the Colonial Office, for which it is essential that only the best, physically and otherwise, should be selected. I may mention that recently Staff-Sergeant L. L. Woodell, R.A.M.C., has been specially granted the Meritorious Service Medal for service with the forces in Northern Nigeria, a reward for which, I am sure, the whole Corps will be proud. I have dwelt on this point of medical examination perhaps longer than I should have done, but after nearly eighteen months' work in that magnificent establishment halfway down the Hill, I am more than ever convinced that the future of our Corps is entirely in our own hands, owing to the fact that we are doctors as well as officers.

As an old officer clerk you cannot be surprised if I say a few words about "returns," those detestable "forms" with lines and cross-lines, notes and footnotes, columns and "demnition totals," which are frequently placed before you. The man does not exist who could make them

interesting, and the best advice I can give you is that they are part of our duty, and as they have got to be done it is worth while to learn how to do them right. Remember also that no man is master in his own hospital if he is not in a position to teach his own clerks. I well remember being at the Gambia many years ago, when my only assistant was a private of the West India Regiment, who could hardly read, when every scrap of every return had to be done by myself. I had to learn then, and the same experience may befall any of you. It may be some consolation to you to know that as regards several of these documents you are no worse off than any officer of any other branch of the Service, as the returns apply to the whole Army; and it certainly will be a relief to learn that after January next the most obnoxious will be transferred to the unfortunate Record Office.

Why the House of Commons, or the public at large, is burning to learn exactly how many Jews or Mahommedans with first-class certificates of education there are in the Army, I do not know, but the information has got to be supplied, and we must supply it correctly.

Sometimes one is involved in difficulties. The other day a man declared himself a "Unitarian." I searched the King's Regulations in vain for assistance, but at last solved the problem by including him among "Other Protestants," and there he will have to stay till the next annual return.

Perhaps a few words on the changes that have occurred in the last twelve months may not be out of place. The most important has no doubt been the enlistment of men for one year with the colours and 11 in the reserve. In June last we were authorised to enlist 190 men under these terms for the General Duty Section. They were obtained in a very few weeks, and in August we received permission to enlist 250 more. This number has now been obtained and, as I said at the commencement of my lecture, recruiting, except for specials, will shortly be suspended. It has been decided that these one-year men cannot extend their service even if they wish to do so. To prevent there being any excess of men serving with the colours, non-commissioned officers and men of this Section (the General Duty Section) have been invited to convert their colour service and transfer prematurely to the reserve. Up to the present time about 40 have availed themselves of the permission. They are all certified to have definite permanent employment in civil life, and I wish them success but—there is no coming back.

Special classes for instruction in sanitation for sanitary sections and squads, and for instruction in connection with regimental water-carts, have been carried on under Lieutenant-Colonel R. H. Firth, and more than 350 have been trained. These men are allotted for special duties with units and on the lines of communication of an army in the field, and have been included in Mobilisation Tables just issued. All these non-

commissioned officers and men must belong to the General Duty Section of the Corps, and many of the one-year men have been through this course of instruction.

In common with the rest of the Army we have lost our reservists in Section "D." That is, that men who have completed twelve years' service either with the colours, or partly in the reserve, are no longer permitted to enlist or re-engage for a further term of four years in the reserve. Section "D" for the whole Army since July last has been in a state of suspense, and the effect will be that we shall lose about 180 reservists of the Corps.

A point of more immediate interest to the Corps is that compounders may belong to any Section. Formerly a non-commissioned officer or man who qualified as a compounder became, *ipso facto*, a member of the Nursing Section. It has now been decided that this classification is unnecessary. The examination has been divided into two parts, and a special Standing Board has been instituted at Aldershot to set papers and examine the answers, so that the examinations may be uniform at all stations at home and abroad. This will, of course, considerably reduce the labours of officers at all stations where boards for examination of compounders were previously held.

As regards the Army Orders recently issued abolishing nearly all extra duty pay and also service pay, it would not be becoming in my position to offer any remarks, except perhaps to point out that all corps and departments of the Army are similarly affected, and so the Royal Army Medical Corps has no special grievance; and to suggest that officers might impress upon their non-commissioned officers and men, that if certain sources of pecuniary emolument are closed, the way to advancement still lies open by qualifying for a higher rate of Corps pay and for promotion. The numbers who are qualifying for the special nursing certificate is satisfactory, but there are still vacancies for appointment to Q.A.I.M.N.S., the additional pay for which has not been touched; and as regards promotion, my seniority rolls tell me that the earlier a man qualifies the better his chance.

I was signing attestations the other day (weary task), and, as a matter of curiosity, I looked at the certificates of education. Scores, almost hundreds, were blank. Here and there a third. Now surely, gentlemen, this is a pity. Even if a man does not want promotion, for which he must have a second, even if a man does not mean to stay in the Army, surely it is worth his while to get a decent education which costs him nothing, and which will be of great service to him in civil life. I do think that here is an opportunity for a little friendly advice on the part of a commanding officer. I can assure you that the letters I often get from reservists and ex-soldiers are pitiful. Letters begging to return to the colours, or asking for employment, from men who, whilst with the

colours, never tried, so far as their documents show, to qualify, either educationally or professionally, for future employment in civil life. I need not tell you that the market for unskilled labour at home is overstocked, that the uneducated soldier who goes to the reserve without any definite employment runs the risk of starving. Unfortunately, the men themselves will not believe it until too late. Then they want to return to the colours, and I cannot take them. On the other hand, I sometimes get appointments offered me for well-trained men for which I cannot conscientiously recommend candidates. Good positions as valet attendants for a really qualified male nurse, a man who can look after a paralysed patient, use the catheter, &c.; clerks "with a good knowledge of accounts"; compounders, as dispensers, in private practice, or in stores; and so on. On the whole, I think we may say that, for well-trained men, we are fairly successful in finding situations, but for the untrained man we can do very little at home. In the colonies the prospect is better, and I am glad to say that as regards Canada certain restrictions regarding reservists have lately been withdrawn. We have more than sixty of our Corps now in that country, and a similar number in South Africa. These, I think, are points which, without being too inquisitorial, an officer commanding might fairly bring to the notice of his men when transferring to the reserve.

There is one thing more which I might bring to your notice before I sit down, and that is the existence of our own Corps Fund—the Fund which gives assistance in cases of distress, or aids in placing men in employment, provides for widows and orphans, and helps in the education of children. Many companies—they are all companies now at home and abroad, and shown as such in the Army List—another step forward in the recognition of the Corps—as a Corps—many companies appreciate the advantages of the Fund, and contribute from their canteens and recreation rooms, but I think *all* should do so; and whether a case of distress occurs at Bloemfontein, Bermuda, or Ballincollig, all should feel that they have a claim, in suitable cases, on the Fund, to which all, in their proportion, have subscribed.

Gentlemen, this address, which I trust has not wearied you, has been all about our men, and I make no apology for trying to interest you in the men you command, and on whom you must rely in peace and war. —*Homo sum et nihil humani a me alienum puto.*

I believe that the Royal Army Medical Corps, officers and men, is going to be the finest branch of the British Army, and I think that it is in the hands of its officers, especially the younger officers, to "make it so."

Reviews.

PRESERVATIVES IN FOOD AND FOOD EXAMINATION. By J. C. Thresh, M.D., and A. E. Porter, M.D. London: J. and A. Churchill, 1906. 14s. net.

THIS is an octavo volume of some 500 pages, dealing with the subjects of the title in a comprehensive manner. In Part I. the various chemical substances used in the preservation of food are considered *seriatim*, their action explained, and some account given of their physiological effects. Brief reference is also made to heat and cold methods of sterilisation. In Part II. the ordinary articles of food that are subjected to preservative processes are dealt with, in regard to the necessity or desirability of those processes from a public health point of view. Part III. treats of the colouring matters that are added to, and mineral poisons that may occur in, articles of food and drink. In Part IV. the laws relating to food inspection are considered (in five pages), and the examination, in regard to soundness of meat, fish, dairy products, fruit, vegetables, &c., by naked eye inspection and by microscopical and bacteriological methods; also the examination of tinned meats, and the subject of food poisoning, are fully dealt with. Part V. describes the chemical tests for preservatives and colouring matters, and gives a *résumé* of legal cases in regard to their use.

Perhaps the keynote to the work is struck in a sentence in the preface: "A careful study of all that has been written on this subject, both at home and abroad, and of inquiries made of medical practitioners, leads one to the conclusion that the dangers arising from the use of preservatives have been greatly exaggerated" (p. vi.). Some of the old-fashioned processes, however, such as smoking and salting, come under the writers' condemnation. With regard to the former it is said that "any modern system of preserving which affected the digestibility to a similar degree would be strongly condemned"; and with regard to salting, although the authors allow that salt "cannot with our present knowledge be considered a dangerous substance in the proportions used for the preservation of food, it will be observed, however, that it labours under the disadvantage urged so strongly against the use of other preservatives, viz., that in large quantities it produces ill-effects, that it is contraindicated in certain diseased conditions, and that it may render food less amenable to certain of the digestive processes" (p. 13). The fact that sodium chloride is a natural constituent of the human body in relatively large proportion (about 200 grammes on an average), and that its presence in the dietary is a matter of imperative necessity, surely places this substance in a category altogether different from the artificial preservatives brought under consideration.

The authors' opinions with regard to the hurtfulness or otherwise of boric acid are not to be readily gathered from Chapter iii. Wiley's conclusions that "boracic acid and borax, when continuously administered in small doses for a long period, or when given in larger quantities for a short period, create disturbance of appetite, of digestion and of health," are given on p. 51, and on p. 54 it is assumed that they are justified: but on p. 53 Liebreich's criticisms of Wiley's investigations are summarised, and stated "to be perfectly fair and reasonable"; as, however, Liebreich's conclusion was that "*no* injurious effect was produced by the administra-

tion of the boron preservatives," *i.e.*, exactly the opposite to that of Wiley, we do not receive much guidance from the authors.

A reasonable criticism is passed on the recommendation of the Departmental Committee of 1901, that salicylic acid should not be used in larger proportion than one grain per pint; lager beer and British wines, fruit juices and syrups, are contrasted; the first-named requires only to be kept for a short time, and would require little preservative; the latter are expected to keep indefinitely and would require more: besides which, the quantity ingested of the latter by any one person is altogether insignificant as compared with that of the former, and is to be measured by ounces instead of by pints, therefore the amount of preservative allowed should be increased.

The "Budde-izing" process with peroxide of hydrogen for sterilising milk, &c., at 50° C. is noticed; it depends on an interaction between the peroxide and the (supposed) enzymes present in the milk, whereby nascent oxygen is produced; it appears to sterilise effectually, without causing any alteration in taste or appearance, but how far the change may affect the nutritive quality of the milk remains to be seen.

The treatment of milk naturally receives considerable attention. Boric acid is, of course, used to a considerable extent; in the table on p. 102, taken from the Departmental Committee's Report, the amount found by Wynter Blyth is erroneously stated as 80 grains boric acid per pint; this figure refers, not to boric acid, but to borax (Report, question 3,439), equivalent to 12·8 grains only, stated as boric acid. The quantity usually added appears to be from 1 or 2 up to 14 or 15 grains per pint; about 4½ grains per pint appears to be the smallest amount that is of any use for delaying the souring process in hot weather. It is pointed out that an infant of four months might easily be taking 3 grains or more daily. The authors are "driven to the conclusion that boric acid, in the proportion necessary to 'preserve' milk, is an undesirable constituent, and that its addition may be associated with considerable danger to health" (p. 106). It is also pointed out that its use, in common with the use of other preservatives, permits of an "unclean" milk being regarded as "clean."

The authors agree with the Departmental Committee's conclusion that formic aldehyde should not be used as a milk preservative; the amount originally added cannot be accurately determined, and there are many opportunities for repeated additions; it certainly appears to interfere with digestion. Salicylic acid is little used, but is regarded as objectionable. It has been suggested that preservatives in milk should not be prohibited, but only limited in quantity, and declaration of their presence made compulsory. This, however, is not approved of.

But perhaps the best argument against the use of preservatives is contained in the fact that "if their use is prohibited, it will be absolutely necessary for dairy farmers to maintain a very much higher standard of cleanliness in and around their cowsheds, and in the actual milking processes, than is often the case. At present, the farmer who pays attention to matters of sanitation obtains no better price for his milk than one who, by addition of preservatives, is able to partially neutralise the effects of the filthy state of his byres. The Cowsheds, Dairies, and Milkshops Order is practically a dead letter in many parts of rural England, but the prohibition of chemical antiseptics in milk should go a long way towards securing the improvements which the Order has failed to effect" (p. 109).

The authors proceed to show that the milk trade of the country can be carried on without the use of preservatives. The Aylesbury Dairy Company have for some years been able to supply about 100,000 persons in London with milk every day, some of it coming from Wiltshire, and some even from Cheshire, 200 miles away; and this without the aid of any preservatives. Mr. Carrington Smith also was able to send 100 gallons a day from his farm in Staffordshire to London (100 miles) without preservatives. The points to be attended to are, first, that the milk should be clean and pure in its origin; secondly, that it should be maintained in this condition, either by the application of heat or of cold. To secure the first condition, the cows must be healthy, and must be kept under healthy conditions, the cowsheds being clean in every particular; also the milkers must be clean and healthy, and the milking must be done under cleanly conditions. To maintain the purity of the milk, it may be cooled down to 50° F., or better, to 40° F., at which temperature the multiplication of the contained bacteria is comparatively slight, and the milk will keep good for twenty-four hours. Difficulties naturally arise in the maintenance of such a low temperature in the summer time during conveyance by rail; the railway companies should provide proper wagons with double roofs. Cooling arrangements are carried out most thoroughly in Denmark by the Copenhagen Milk Supply Company, who have demonstrated the practicability of this method of milk preservation.

The application of heat brings about some changes in the milk, and is therefore open to possible objection: boiling is said to interfere with its digestibility, but the evidence is conflicting. The discussion of this debateable question is not so full or satisfactory as might be wished, considering its importance. Dr. Clement Dukes is quoted as the authority for the statement that the use of cooked (*i.e.*, boiled) milk is the cause not only of infantile scurvy, but of rickets; it is said (p. 126) that there is a fairly general consensus of opinion amongst those who have studied the subject and had the opportunity of making observations, that scurvy rickets occurs chiefly amongst the children of the better classes, and especially amongst those who take the precaution of boiling all milk before use. It may be doubted if any such general agreement of opinion really exists;[1] but if it be admitted, the danger from the use of such an exclusive diet can only occur in the case of young infants (who may be protected therefrom by suitable precautions), and is non-existent for the much larger number of older children, who are not restricted to a milk diet (and therefore not liable to contract scurvy in this way), but who are, all the same, liable to all the various milk-borne diseases, unless proper measures are adopted to keep the milk pure, or to purify it. If purification be necessary, pasteurisation is undoubtedly the best method in practical use at the present time. The authors, however, seem to hesitate here, as elsewhere; for although on page 126 they appear to join in the "general consensus of opinion" just mentioned, on the next page, after citing the Continental custom of sterilising milk, they say, with regard to the rarity of scurvy and scurvy rickets, that "it is obvious that

[1] See (besides Dr. W. B. Ransom's paper, which is quoted by the authors) Professor Rotch's address at Manchester meeting (*British Medical Journal*, September 6th, 1902); the experience of the *Gouttes de Lait* in Paris and elsewhere, and that of de Rothschild and Abramoff (*British Medical Journal*, May 2, 1903), and of the *Clinique Tarnier* (*British Medical Journal*, February 20, 1904).

the danger of contracting these diseases from the use of boiled milk is very slight indeed, and has been grossly exaggerated."

Summing up, with regard to milk, the authors condemn the use of preservatives, and consider that refrigeration is greatly to be preferred to pasteurisation and sterilisation. This view will meet with general assent, if the existence of, and resultant danger from, specific germs of disease in milk be left out of consideration; as things are at present it would be a bold course to pursue.

An interesting account is given of the butter industry from a sanitary point of view. About half the butter sold in England comes from Denmark and is free from preservatives, except only a little salt; the remainder (Irish, French, Colonial), except such as is produced locally, mostly contains boric acid or borax, usually with a little salt or saltpetre. This is because butter is made all the year round in Denmark, and is consigned to England once or twice a week; in the other countries it is made chiefly between April and November, and is consequently stored for some months. In Denmark and America a great deal of scientific work has been done in regard to dairy products; the micro-organisms concerned in the production of the most appreciated butter flavours have been isolated in the laboratory, and can now be purchased by farmers. They are known as "starters." In Denmark the cream is first pasteurised to get rid of the unnecessary germs, and some milk added, in which the laboratory "starter" has been allowed to propagate. It is then kept at the temperature most favourable to the growth of the particular organism. Objectionable flavours are not due, as generally thought, to the pasture, or to cows feeding on turnips, &c., but to some specific microbes, which can be excluded by appropriate treatment.

It has been found that butter made from pasteurised cream with the aid of a "starter" will keep two or three weeks with only ½ per cent., and for two or three months with 3 per cent. of salt. One half per cent. of boric acid is enough.

In reference to the conveyance of milk in this country the need for special refrigerating waggons is rightly insisted on, such as are now provided by the Great Western, North Western and Great Central Railways, and by the Great Southern and Western of Ireland, but apparently not by any other companies.

Alcoholic beverages, temperance drinks and fruits, jams and vegetables are next considered. In Chapter xiv. meat foods are dealt with. On account of the change in public taste in recent years and the preference for "mild cured" foods, ham and bacon, that are so largely imported from America, are packed "green" (*i.e.*, not salted, or only to a very slight extent) in boric acid; this, although only applied to the surface, is absorbed into the interior of the meat. One consequence is that potted meats in this country almost always contain boric acid. It does not seem that packing in boric acid is absolutely necessary, as a Wiltshire firm exports bacon to India and the Colonies, using a little more salt than usual, extra drying, and then packing in salt (p. 169). In any case the injection of boron preservatives into the substance of the meat is objectionable. The quantity of boric acid that is sufficient to act as a preservative (when used as packing) appears to be 0·25 per cent. of the weight; sometimes 1 per cent. is used. The quantity actually present in the meat has been found to be as much as 0.661 per cent. (= 46·3 grains per lb.) boric acid (Somerset House Laboratory).

Sausages have been found to contain 1·14 per cent. (79·8 grains per lb.) boric acid. This might produce unpleasant symptoms.

Part III. (Chapters xv., xvi.) treats of colouring matters. Some of these are curious, though probably most are harmless. Margarine is very generally coloured (with a coal tar pigment); cheese also is often coloured with annatto, as, of course, is butter; though for this the coal tar yellow, tropæolin, is also used.

The most important pigment, however, used in the food industry from the health point of view is probably sulphate of copper in preserved vegetables (peas, beans, &c.). It is well known that the Departmental Committee on Food Preservatives condemned the use of copper as a colouring matter; one member, however, did not join in this absolute condemnation, advocating only declaration of its presence, and limitation of the amount to a quantity equivalent to 0·5 grain per lb. metallic copper (= 0·07 parts per 1,000). The usual amount found in preserved vegetables is about 2 or 3 grains per lb. of crystallised copper sulphate (= 0·5 to 0·75 grains per lb. metallic copper): as much as 26½ grains per lb. have been recorded. The authors consider that "in the present state of knowledge concerning the action of small doses of copper on the human subject, the desirability of the addition of this substance to vegetables must be largely a matter of personal opinion. On the one hand it is certain that copper is a poisonous substance even in moderate quantities, and it is highly probable that some, if not all of it, in preserved vegetables is in a form which is soluble in the digestive juices. On the other hand, it is certain that if the copper is omitted the vegetables will lose their colour; and it is generally held that the appetising appearance of food has considerable influence on the digestive processes" (p. 183). We quite agree that this is largely a matter of opinion: when the alternative lies between ingesting a metallic poison in a soluble condition on the one hand, or eating peas that do not appear to be quite bright and fresh (as, indeed, who could expect them to be in December?) on the other, we do not think there is much doubt what the opinion of sensible persons would be. *Manet sors tertia* of leaving tinned peas alone altogether, which would not be a great deprivation; at any rate, the public taste might be educated to dislike metallic poisons even in minute quantities and of attractive appearance. We are glad to know that many local authorities are now taking action, and successfully prosecuting persons for selling coppered vegetables as being "not of the nature, substance and quality demanded," and as being sold "to the prejudice of the purchaser."

A good *résumé* is given in Chapter xvi. of the occurrence of mineral poisons in articles of food and drink, arsenic and lead being those chiefly dealt with.

Part IV. (Chapters xvii. to xxvi.) treats of the occurrence of disease in relation to the various articles of food and drink, and their inspection and examination. In chapter xxi. the bacteriological examination of oysters and other shell-fish is considered. The authors are here not clear in their pronouncements. After alluding very briefly to the experiments of Klein and of Houston, it is said (p. 259) that "he would be a bold man who would dare to condemn oysters (and therefore the layings from which they were taken) from a mere bacteriological examination." On the next page we read that "the mere fact that certain bacteria are present in the liquid within the shell or in the body of the fish is no

proof of sewage contamination, but if they are present in large numbers there is presumptive evidence of such pollution." Which course do the authors really advise? What we take to be the correct view is that stated in the latter paragraph: presumptive evidence is surely sufficient to condemn, and if the careful procedure laid down by Houston (Fourth Report of the Sewage Commission, 1904) be followed, the investigator who ventures on a condemnation may be bold but would not be rash. Possibly the authors may have only meant to warn observers against condemnation on account of the mere presence of certain bacteria, but what they actually say is on "a mere bacterial examination," which is a very different thing. The authors do not allude to the work of the Massachusetts Board of Health observers, which agrees with that of Houston, to the effect that, in undoubtedly unpolluted shell-fish *Bacteria coli* is absent, or but very sparsely present. A good description is given of the procedure for detection of *B. coli*, but the little word "not" is omitted in reference to the production of indol (p. 261). When both true *B. coli* and *B. e. sporogenes* can be found in $\frac{1}{100}$ of an oyster it is probable that the batch comes from a contaminated source; the authors would, therefore, probably be bold enough themselves to condemn such oysters as unfit for consumption. A summary of Klein's method, described in his Report to the Fishmongers' Company (1905), is given without comment.

The connexion of outbreaks of disease with milk supplies (Chapter xxii.) is treated rather cursorily: the transmission of diphtheria by milk is considered doubtful; very little is said about enteric fever. It is stated (p. 275) with regard to "blown" tins of condensed milk, that there is no record of any illness resulting from the use of such milk, that young pigs are not affected by it, and that bakers use it in making bread and pastry without apparent ill effects; it should, however, be regarded as unsound. A full account is given of the important case (1905) in which Dr. Sykes pronounced a sample of milk to be unfit for food, owing to the presence of cow dung, &c., and which was subsequently found by Dr. Eyre to contain virulent tubercle bacilli. The St. Pancras Borough Council prosecuted, the case was heard at the Marylebone and Tower Bridge Police Courts, and the defendant was fined £25 and costs. This is the only hitherto recorded case in which milk has been dealt with by seizure as an "unsound food." As the authors say very truly (p. 280): "A few prosecutions of this kind would probably effect a greater change for the better than all the bylaws which can be devised." What is wanted is a vigorous carrying out of existing powers rather than additional refinements of legislation.

In Chapter xxiii., which treats of the examination of milk, a good method is described for making a quantitative test of the dirt present. Take a litre of milk, allow to stand in a long glass for three or four hours, siphon off the upper 975 cc., to the remaining 25 cc. add 500 cc. aq. destill. and again allow to stand; repeat until the water remains clear; transfer deposit to a tared filter, dry and weigh. "A really clean milk will not yield more than 3 to 5 mgms. of dry residue; ordinary samples may yield from 10 mgms., or even more, according to the degree of foulness" (p. 284). If more than 10 mgms. are found, and the microscopic examination of the residue, obtained by a centrifuge, shows that it is of objectionable character, the milk may fairly be considered unsound,

and unfit for human consumption. Full details are given of the bacteriological examination.

Four tests are described for detecting if milk has been boiled or pasteurised—the old guaiacum test, and three tests with hydrogen peroxide—the complementary reagents being respectively hydroquinone, ortho-methyl-aminophenol and metol. The authors do not state which they recommend.

An interesting point is mentioned in connexion with condensed milk. It is usually assumed that blown tins are unfit owing to decomposition of the milk. The authors, however, state that this is not correct, as in some such cases the milk has been found to be absolutely sterile; they quote Dodge as affirming that the blown condition may be due to electrolytic action between the metals of which the can is composed and acids generated by bacterial growth in the milk before condensation. No reference is given to the original account of this observer's work, which is a pity. In such cases the authors question whether a whole batch of tins should be condemned if a few are found to be blown; but in circumstances where every individual tin cannot be separately examined, we think that it would be well to err on the safe side and condemn.

In Chapter xxiv., treating of fruit and vegetables, the typhoid outbreak at Hackney in 1903, due to watercress, is described. In a sample of water from one of the watercress beds at West Ham no fewer than fifty *B. coli* were found per cc. Under the mention of bread it is noted that baking does not thoroughly sterilise a loaf, and that bacteria and moulds may be cultivated from the central portion. The observations of Waldo and Walsh, a few years back, are not, however, referred to. No doubt there is a real need for strict sanitary supervision of bakehouses and their water supply.

Food poisoning is dealt with in Chapters xxv. and xxvi.: the account of the outbreaks that are mentioned is not as detailed as might be wished. On the general question the authors' opinion (p. 309) is, that "it is exceedingly doubtful whether the ptomaines ever occur in food products in sufficient quantity to produce poisonous effects. In practically all cases, when a substance is being examined for ptomaines, it is found that the liquid containing them is far more poisonous than the alkaloids isolated therefrom, and many ptomaines which have been isolated have little, if any, deleterious effect upon the system. It is not surprising therefore that many now hold the opinion that the term ptomaine poisoning is a misnomer, and that the poisons produced in foodstuffs from the proteid matter therein are not of the nature of alkaloids. To these poisons the generic term of 'toxin' has been applied, and they appear to be more nearly related to such active principles as ricin and abrin occurring in certain plants, and with venin, the active principle occurring in the venom of various species of snakes, the chemical nature of which remains as yet unknown." While in some instances the symptoms are probably caused by bacterial products formed in the food prior to ingestion, and are therefore true "intoxications," it is held that the large and serious epidemics of meat poisoning are more frequently of the nature of "infections." It is noted that the presence or absence of an "appreciable incubation period," usually cited as a distinction between the two, is not a true criterion; but Delepine's important detection (in the Derby case, 1902) of a Gaertner-like bacillus, capable of growing with such rapidity that broth was made turbid in two hours, which furnishes a reasonable

explanation of such outbreaks, is not alluded to. This subject of food poisoning is a difficult one, and it cannot be said that the account here given is particularly illuminating. The facts do not appear to be well arranged.

The examination of food in the next chapter is dealt with clearly and systematically. It is pointed out that, before making a chemical examination, feeding experiments should be carried out to ascertain if a poison is present; and that mice should be used, not rabbits or guinea-pigs, since these animals cannot vomit.

The detection and estimation of preservatives is well described in Chapter xxvii., metallic impurities and colouring matters being considered in the next two chapters. The volume terminates with a useful *résumé* of legal cases.

As a whole, the book justifies the opinion of the authors in the preface, that there is no work "in which this subject of unsound food in its relation to health is so fully dealt with as in the present volume." It will undoubtedly prove "of practical value to medical officers of health and others interested in the nation's welfare." Its usefulness would have been increased if more numerous and fuller references had been given to original authorities. The Departmental Committee's Report is very largely drawn upon, but in almost all cases without exact reference. In many cases an insufficient reference is given; as on p. 14, where Liebreich's "Effects of Borax and Boric Acid on the Human System" is referred to, without date and without page or chapter. On p. 267 it is said that "in London dairies it is estimated that 25 per cent. of the cattle are suffering from tuberculosis." This assertion might have some value if the grounds on which it is based were stated. The advice as to verifying one's references is certainly not superfluous in the present case, as there are several misprints in this volume. We notice "thermophylic," (p. 1); "acid radicle" (p. 125); "Dairy Produce Association" (p. 131) for Dairy Products Committee of Central Chamber of Agriculture; "*P. breviculare*" for "*brevicaule*" (p. 198); "Sir R. Buchanan" (p. 272); in the tabular statement on p. 179 the figures in the maximum and minimum columns (in regard to brandy and peas), should be transposed.

SYPHILOLOGY AND VENEREAL DISEASE. By C. F. Marshall, M.D., &c. London: Baillière, Tindall and Cox, 1906. Pp. 509, 5 plates, large post 8vo. 10s. 6d.

Dr. Marshall has chosen a suitable occasion for completing and publishing his book on the venereal diseases. Even before the discovery of the *Spirochæta pallida*, by Schaudinn and Hoffmann, the revival of interest taken by the medical profession in this subject had become sufficiently manifest. It was recognised that our want of accurate knowledge as to the parasitology of syphilis had become a disgrace to medical science, and the remarkable medley of views as to the treatment of the disease had long required systematic arrangement. The result of these opinions showed itself in many ways throughout the profession, and the Army Medical Department has taken its full share in promoting the revival of this interest.

The reports of the Advisory Board, issued from Headquarters, are, in themselves, a textbook of modern treatment, and Dr. Marshall's conclu-

sions, so far as treatment is concerned, coincide very closely with the opinions expressed in these reports.

In Dr. Marshall's book the value of the discovery of the Spirochæta is prudently appreciated. As the result of a careful review of the subject he says, "It is, therefore, permissible to assume, in the present state of our knowledge, that the *S. pallida* is the pathogenic microbe of syphilis, and that lesions in which it is found are contagious."

Dr. Marshall is, however, not content with giving a *résumé* of the ordinary manifestations of syphilis and their treatment, but has made his work more complete by reviewing the results of syphilis as they affect the circulatory system, the alimentary system, the respiratory system, the early and late effects on the nervous system, and on the other organs and tissues of the body. There are chapters also on syphilis in relation to life assurance and marriage, hereditary syphilis, and syphilis of the third generation, on the experimental inoculation of syphilis in animals, and on the researches towards a serotherapy of the disease. It will thus be appreciated that his work is very complete, and we are pleased to be able to add that it is very thorough.

The chapters on gonorrhœa and other venereal diseases naturally occupy a smaller compass than those on syphilis, but the information in these sections is also sufficiently ample, and the treatment is reviewed from the standpoint of recent investigation.

We are glad to observe that Dr. Marshall has not omitted to add a copious bibliography on the subject, an addition which will be much appreciated by many members of the Corps.

Dr. Marshall's book has the additional advantage of being well written and therefore readable. This book can be safely recommended as a trustworthy *résumé* of our knowledge of these subjects at the present time.

A Manual of Bandaging. By C. Henri Leonard, A.M., M.D. London: Baillière, Tindall and Cox. Pp. 159, 139 illustrations. 3s. 6d. net.

This book, which was first published thirty years ago, appears to have undergone little or no revision since that surgically remote period. It contains much useless information, and not a little that is misleading and dangerous. It is difficult to deal seriously with a work in which a charcoal poultice is said to be "antiseptic and disinfective," and in which oakum is recommended as an antiseptic surgical dressing. The author seems to have a touching belief in the efficacy of bandages in preventing what he terms "vicious cicatricial contraction" after burns; the other main functions of bandages apparently being "to confine poultices" and "to restrain swelling" in cases of fracture. It is quite in keeping with such teaching that the rules given for determining whether a bandage has been too tightly applied are quoted from Hippocrates, no reference being made to the circulation in the distal portion of the limb; with such an authority for a guide it is evidently needless to mention the work of a mere modern, like Harvey.

Among the large number of bandages described and figured are some that are useful, many that are complicated and ineffectual, and some that are so simple that they might well have been omitted. The nomenclature employed is startling in its pomposity; as an instance, the method of drawing back the shoulders by means of two handkerchiefs, is here called the "compound dorsal bi-axillary cravat." French terms are used where

English equivalents would be simpler and more readily understood. The descriptions of bandages are, on the whole, clear and straightforward, and the figures are good. It would be easy, were it worth while, to draw attention to other faults, but enough has been said for our purpose. A book of this nature is intended for students and nurses, and may do much harm by misleading those who are unable to discriminate between sound and unsound teaching. This work is altogether untrustworthy and cannot be recommended.

Correspondence.

THE FUTURE OF THE JOURNAL.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I trust you will excuse the liberty I take in making the following suggestions, but I know that a considerable number of our officers do not subscribe to the Journal, which fact would seem to prove that there is a lack of general interest and that it is not widely popular. If such is the case it is much to be regretted, for I am sure that those of us (and there are very many) who have the interests of the Corps at heart feel that if we can extend its popularity so as to secure the support of all—or nearly all—the results may well be of the most far-reaching character, in the fostering of that cordial feeling of *camaraderie* and regard for the well-being of the body politic, which is usually included in the generic expression *esprit de corps*. It is evident that any scheme of reform must of necessity be dual in its inception—critical on the one hand, suggestive on the other.

First, then, as to criticism. It appears to me that, heretofore, the tone of the Magazine has been too ultra-scientific, too strictly professional, and especially, too prominently bacteriological. No doubt to the expert it may be highly interesting to know that under certain conditions monkey 27 is + and guinea-pig 43 —; but, to the non-expert, it is somewhat wearisome to wade through columns of such experiments; he either skips them, or, if he does not, they convey no mental impression. The *results* are interesting and therefore should be published, but surely these long lists of numerical monkeys and guinea-pigs might be relegated to appendices or stored amongst the archives and available for reference. You cannot pump up any enthusiasm about a number, and if these earnest workers would even condescend to call monkey 27 "Jacko," and guinea-pig 43 "Sue," it might, conceivably, excite a passing interest, and, so to speak, impart a little colour to an otherwise bald statement. It reminds me somewhat of the man who, after reading some pages of a dictionary, remarked that "it was very interesting, but he could not quite follow the thread of the narrative." Moreover, there are hosts of journals and magazines already existent whose pages are open to such contributions. Understand me, however, clearly. I do not for a moment advocate the elimination of all

such articles, far from it, but I think that there should be a greater sense of proportion, and that they should not occupy so much space as hitherto. It was of set purpose that I wrote the article, "The Humour of Indian Sanitation," which you were good enough to publish a few months ago; it was an attempt to lift the Journal out of a rather dreary groove, and, from what I have since heard, many appreciated it.

And this brings me to my second point. I am one of those who believe that a tactical blunder was made in the inauguratory number of the Journal when it was enunciated that nothing controversial would be admitted into its pages. Pugnacity is a national characteristic, and is, to my mind, an evidence of virility. Controversy is the very life-blood of journalism, and when this latter degenerates into the "prunes and prisms" type it is prone to pall and prove stale and unprofitable; it lacks *goût*—what the Yankees aptly designate "snap"—and I doubt if there is a single magazine in existence which has attained to a position of success on a policy of this kind; therefore I think that an anæmic attitude of oleaginous dulness spells ultimate disaster. There are always two sides to every question, and it should not be a difficult matter to present these two sides (under editorial supervision) without trespassing beyond the bounds of discipline or rubbing military susceptibilities the wrong way. I am not advocating the encouragement of carping criticism and habitual "grousing"; nothing of the sort, but what I do plead for is a little stirring up of the dry bones and some indication that our junior officers are such; not be-spectacled, bald-headed professors, nourished on a diet of skim milk, backward in expressing an opinion, and with a fearsome skiagram of irascible (perchance irrational) P.M.O.'s indelibly printed on their cerebral convolutions. In illustration of my meaning: How would it do to devote three or four pages monthly (or more on occasion) to questions of general interest, which may afford ground for differences of opinion? Under some such heading as "The Two Sides of the Shield," and a sub-heading of the well-known couplet—

> "Oh, would some power the giftie gie us,
> To see ourselves as ithers see us!"

many an useful hint might be forthcoming. Innumerable subjects open to legitimate discussion suggest themselves. For example, why should we not know how officers regard the scheme of accelerated promotion by examination? or what is thought of the College course—its instructional value, educational advantage, and the like? Or, why might we not elicit from the rank and file their ideas of the merits and shortcomings of our hospitals, our sanitary restrictions, regulations and so forth? None of us are infallible, and it might well happen, on the one hand, that we might be less dogmatic and dictatorial if we could grasp the view-point of the victims of our vagaries; and, on the other, remove misapprehension by editorial comment. I see no reason, moreover, why correspondents should not use pseudonyms if they so desire; it would

promote freedom in the expression of opinion, and abuse could always be checked by the exercise of the editorial veto. Similarly, if a *nom de plume* were allowed, and its inviolability recognised, we might extract many interesting personal experiences and reminiscences which the authors might be chary of recording if their identity were revealed; parenthetically, it may be added, that here also the editor might control any threatening epidemic of the Gilbertian malady—"a taste for faultless fact." Or, again, why should not the Journal take up the cudgels in our defence when ill-informed, irresponsible anonymity vilifies us by parading mendacious "facts" in the columns of contemporaries? I do not believe in taking abuse "lying down," or turning the other cheek to the smiter; ethically, no doubt, it is very commendable, but in a workaday world it pays better to hit back, and hit hard.

Lastly, the *clientèle* of our Journal is necessarily limited, and even if every officer subscribed financial success would scarcely be assured. Why not therefore make a bid for an extended circulation by giving more encouragement to our brethren in the Reserve Forces to discuss questions in which they are more directly interested? Such expansion, moreover, might well mean increase in advertisements.

I apologise for the length of this letter, but the subject appears to me to be an important one; and I may be allowed to express the hope that, having raised it, others will favour us with their views, so that we may gauge what is the true path to that success whose attainment is comprised in the triple formula, instruction, general interest and concomitant popularity.

Yours faithfully,

R. H. Forman,
Colonel, R.A.M.C.

Bombay,
December 11th, 1906.

THE TREATMENT OF SCABIES BY BALSAM OF PERU.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—Since Lieutenant-Colonel S. C. B. Robinson, R.A.M.C. submitted his paper on the above subject to the Director-General in August last, this method has been subjected to further trial (to the exclusion of all others) in the Military Hospital at Colchester.[1] The results have been absolutely satisfactory. In no case has the patient ever complained of itching, either on the first night after the application or subsequently. This would appear to prove that the parent Acarus is killed within a few hours. As regards the ova, it is uncertain whether the fumes of the balsam have the power of penetrating the capsules at all stages of their development, or whether it is necessary for them to arrive at some stage of maturity before it is effective. I have referred this

[1] [An account of the method employed at Colchester was published in the Journal for January, 1907, p. 52.—Ed.]

question to Dr. James Galloway, a member of the Advisory Board, and an authority on skin diseases. He replied as follows: "So far as I know no authentic data can be given as to the actual death of the ova of the *Acarus scabiei* after the application of a parasiticide to the skin. Any statements as to the probable duration of life are derived from clinical experience only." It was on account of this uncertainty that bathing was forbidden for one month after the application of the remedy. From further observation it has been found that, provided the initial bathing and application are *faithfully* carried out, there is no necessity to prohibit bathing for so long a period. The later cases have been allowed a bath after fourteen days, and in future it is intended to gradually reduce this period. It is very probable it will ultimately be found that it will be quite safe to allow bathing after two or three days, as is done in some of the continental armies where this treatment is carried out. The patient should be kept in a *very hot* bath for at least half an hour and soap plentifully used. The other day I caught a patient standing in a tepid bath and washing himself without soap. Such a case would have been quoted as a relapse. The varnish must be evenly and continuously applied to the whole surface of the body. Three ounces of balsam mixed with 1 ounce of glycerine is required for a man of average size. The whole treatment *must* be supervised by an intelligent orderly.

I am, &c.,
F. J. W. Porter,
Major, R.A.M.C.

Colchester,
December 24th, 1906.

THE "ALLIES" OF ENTERIC FEVER IN INDIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—Lieutenant-Colonel S. Glenn Allen, R.A.M.C., in his interesting article "The 'Allies' of Enteric Fever in India," in the January number of the Journal, mentions "the Thornhill system of trenching" as being one of the dangers of the Indian conservancy system. With the rest of his article I am in general agreement, but in this particular I feel bound to differ from him. The problem of enteric fever in barracks in India depends, in my mind, in the first place on the question of removal, in the second place on the question of removal, and in the third place on the question of removal; and under "removal" I include custody of excreta pending removal. The question of "disposal" I look on as entirely secondary. Given a good system of removal, a system, that is, which follows the old maxim of *cito tuto et jucunde*, and which removes to a safe distance and safe position, and the method of disposal is, in my opinion, *quâ* causation of enteric fever, a matter of small importance.

The crux of the matter is the safe distance and the safe position. As regards the former I would say at least two miles; as to the latter the prevailing wind, and in strategically important stations the possible permanent or temporary extension of the cantonment must be taken into consideration.

We come now to the question of disposal. What do we actually mean by the word? Do we mean the hiding away of the sewage where it will not be again seen, but remain more or less unaltered, or do we mean its biological resolution; in other words, the complicated series of changes usually denoted by the word "nitrification"? Surely the latter. We cannot at this stage in our civilisation consider any deep burial of sewage as otherwise than a temporary expedient, yet this is what Colonel Allen advocates. Nitrification is what we should aim at, and this can be obtained in two ways. One is by a "biological" installation (septic tank and filters, for instance), the other is by application to the land. The former is out of the question in Indian cantonments in my opinion; the expense of sewering so scattered a collection of buildings would be prohibitive, and without a water carriage system a biological installation is a difficult affair to manage. I am aware that it is done, and successfully done, at Maymyo, in Burma, but I do not think such an installation would meet with success elsewhere for many reasons.

Application to the soil remains, therefore, the only available road to nitrification, and that is best attained, in my opinion, by Colonel Thornhill's system of trenching. But his system must be carried out with the strictest attention to detail. When properly carried out there is such complete admixture of the soil with the fæcal matter that within twenty-four hours the presence of the latter cannot be recognised by the eye, and hardly by the nose. That this system can pay, or partially pay, its way is an advantage which, as sanitarians pure and simple, we may disregard. As men of the world we cannot afford to do so. The success of any system of disposal depends, not on the Sanitary Officer who recommends, but on the Cantonment Magistrate who carries out the work. If the work is to be unreproductive, if the filth, that is, is to be buried merely as a means of hiding it, then we cannot expect the Cantonment Magistrate to take any particular interest in the matter. If the work is to be reproductive and bring grist to the cantonment mill, then not only can we demand that he shall interest himself in it, we shall find him doing so for his own sake.

I admit that there are stations in India, Quetta, for instance, where the Thornhill system is difficult to carry out, if not impracticable, owing to difficulties with regard to procuring suitable soil. In such places biological installations should be set up. Quetta is the most ghastly commentary on the "deep burial" system, that one could wish to see. It was instituted there on the recommendation of a committee, of which I was a member, in 1898, as a *temporary expedient*. It has been continued as a permanent system, and I think one visit to the Sahibzada pits would be sufficient to convict any believer in deep burial of the error of his ways.

I am, &c.,
CHARLES H. MELVILLE,
Lieutenant-Colonel, R.A.M.C.

War Office,
January 9th, 1907.

THE PREVENTION OF ENTERIC FEVER IN INDIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I see by his very interesting "Notes on Enteric Fever Prevention in India,"[1] that Lieutenant-Colonel F. W. C. Jones, R.A.M.C., is one of those who believe that the fly lays her eggs in the night-soil trenches, and I am sure that there are many who would be much interested to know if he has made any experiments that bear out this theory. On page 237 of Colonel Caldwell's "Manual of Military Hygiene," is mentioned an experiment which tends to prove the contrary, as does the fact that flies are not seen over properly-filled recent trenches, although a few days later the same trenches will be swarming with maggots.

Flies have ample opportunity for laying their eggs in most latrines where the pans or buckets are not changed or covered immediately after use, and this will apply to nine out of ten of all the latrines, civil or military, that I saw during five years' service in India. Where the sweeper is absent or remiss, there flies will be found. I failed absolutely to find any other breeding grounds of flies than the night-soil trenches. I never found any larvæ in collections of stable litter or in the rubbish trenches, and I am inclined to think that the reason is that these collections rise to a much higher temperature than do the trenches.

Last winter there was an outbreak of enteric fever in the 17th Lancers at Meerut, then just arrived from home. On the advice of Lieutenant-Colonel Aldridge, then Sanitary Officer, Eastern Command, India, the dry-earth system was discontinued in the regimental lines and a 2 per cent. solution of crude carbolic acid was substituted, a supply being put into each pan to receive the fæces. As a result of this the flies at once disappeared from the latrines, although a neighbouring native latrine where dry earth was still used contained as many as ever. With the disappearance of flies from the latrines the larvæ disappeared from the trenches. I do not think that this can have been caused by the action of the dilute carbolic solution on the soil, although this was enough to delay the ordinary changes in the night soil for eight to ten days.

In the laboratory flies have emerged from specimens of night soil covered with six inches of well-powdered earth; they do not, however, hatch out in wet earth, and it is well known to all *bildars* that maggots are not found during the monsoon. This, perhaps, accounts partly for the great diminution in the admissions for enteric fever during the monsoon, the disease as a rule only appearing in July, August and September, in Meerut at any rate, when the rains have "failed." It recurs after the rains are over, when dust and flies reappear. There is a similar diminution when "Christmas rains" occur.

With regard to birds, I have only seen the large birds where slaughter-house offal was buried; *mynahs* are found over trenches containing larvæ.

I am, &c., C. H. STRATON, *Captain, R.A.M.C.*

[1] JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, January, 1907, p. 22.

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Original Communications.

RECENT RESEARCHES INTO THE EPIDEMIOLOGY OF MALTA FEVER.[1]

BY COLONEL DAVID BRUCE, C.B., F.R.S.
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IN this place it is not necessary to go into any detail in regard to the history or symptoms of this fever, but a few introductory words will not be amiss.

Malta fever, as you are all aware, is a disease of long duration, averaging four months, but in some cases dragging out its weary length for one, two, or even three years. The temperature-curve is characterised by extreme irregularity, fresh exacerbations of fever being frequent. Another prominent feature of this fever is the presence of symptoms of a rheumatic or neuralgic character. Few marked cases pass through their course without the occurrence of painful and swollen joints or neuritis in various nerves, which combine with the prolonged temperature to bring the patient to a condition of extreme anæmia and debility from which recovery to health is slow.

I think I have said enough of the nature of this fever to impress upon those of you who are not familiar with it the importance and severe nature of the disease under discussion.

Historical.—Let me say a word in regard to the history of

[1] A paper read before the Epidemiological Society, February 15th, 1907.

Malta fever. This fever has naturally been chiefly worked at by Army medical officers who have come in contact with it among the garrisons in Malta, Gibraltar, Cyprus, or at Netley Hospital. Those interested in its history should read the old accounts of it by Marston in 1863 and Veale in 1881. At that time it was generally considered to be malarious in origin, and was usually returned as remittent fever; but the most severe cases were often returned as enteric, and the very mild as febricula or simple continued fever. In 1887 the specific micro-organism, the *Micrococcus melitensis*, was discovered, which effectually separated it from other continued fevers; and it found a place in the third edition of the "Nomenclature of Diseases," published in 1896. In 1904, as the incidence of this fever among the garrison of Malta had increased to a marked extent, the Royal Society, at the request of the Admiralty, War Office and Colonial Office, undertook its further investigation, and sent out a small Commission to Malta for that purpose. This Commission has been at work during the summers of 1904, 1905, and 1906, and the Royal Society has already published seven volumes of reports. It is a summary of the work done by this Commission which forms the subject of this paper.

Geographical Distribution.—In regard to the geographical distribution of this fever a few words will suffice. One curious thing is that it has almost or quite disappeared of late years from Gibraltar, where some years ago it was very prevalent. In the Mediterranean it undoubtedly occurs in such places as Tunis, Algiers and Alexandria, as well as in Malta. It also occurs in such widely separated places as South Africa, India, China, the Philippine Islands and America. It has, therefore, a world-wide distribution, although nowhere does it seem to occur in such numbers as in Malta.

In regard to other etiological factors, such as the influence of age and sex, of occupation, length of residence, climatic conditions, &c., I must refer you to the reports, where the matters are entered into very fully. Permit me, however, to glance briefly at one or two points which I consider of interest.

Social Position.—Here we come against a curious fact, and one which it was impossible to explain until lately. It may be stated, broadly, that the better the social position the more the liability to this disease. Officers and their wives and families, living in large, airy and clean houses, suffer more frequently than the men in their more crowded barrack-rooms. In fact, the risk of the military and naval officer to take this fever is more than three times as great as in the case of the men.

This higher incidence among the officers cannot be explained by sanitary conditions, by convection of the disease by mosquitoes, or by inhalation of infected dust, or any of the theories usually held, as the officer is, if anything, less exposed to these influences than the men.

Climatic Conditions.—The climate of Malta, as you are aware, is extremely hot and dusty from about the middle of June to the middle of October, while the winter months are correspondingly bleak and wet. Now, although the number of cases of Malta fever do show a marked increase in summer, yet it is a disease which is prevalent all the year round, one-third as many cases occurring in the coldest and rainiest months as in the hottest and dustiest. Another fact of interest is that if we study the incidence of Malta fever in individual years we are struck by its irregularity, a large number of cases suddenly appearing in February or December, or other of the cold and rainy months. It was found difficult to reconcile these facts with mosquito or dust theories of propagation.

Distribution of Malta Fever among the Civil Population.—Until recently it was supposed by many of us that this fever was restricted to the inhabitants of the cities surrounding the Grand Harbour. This was in the days when the theory was held that the virus was carried in sewer air or other foul gases. As the Grand Harbour in those days was a huge cesspool, the drainage of the cities falling into it, there was some excuse for a belief in the theory. Malta fever is now known to occur in every part of Malta, and, in fact, the very general distribution of the fever is very striking. It is not the cities round the harbours which are struck most heavily, some of the inland towns and villages showing a much greater incidence.

It is evident, then, that the incidence of Malta fever cannot depend upon sanitary conditions, since the greatest variety exists, from the paved, drained, swept Valletta, to the inland towns and villages where the most insanitary conditions prevail. It cannot depend on the water supply, since there is often a larger number of cases in towns with an excellent supply of pure water than in towns which depend for their supply on shallow wells. The cause must be sought in some condition which affects all classes and all conditions.

Distribution among the Garrison.—Next I would draw your attention to the prevalence of this disease among our soldiers and sailors in Malta, in order to impress upon you the importance of

this disease to the State. Among the soldiers, who average, as a rule, about 8,000, there is an average yearly incidence of 37·6 per 1,000, or 312 admissions to hospital every year for Malta fever. Among the sailors there is an incidence of 28·55 per 1,000, or about the same number of admissions to hospital as among the soldiers.

Now as the average duration of this disease may be put down at four months, it means that 624 soldiers and sailors are in hospital 120 days, which makes 74,880 days of illness. What an amount of personal suffering and loss to the State this sickness and invaliding entail it is impossible to estimate, but the mere pecuniary loss must be very considerable.

Study of the Micro-organism which causes Malta Fever.—It is evident from the foregoing account that little light has been thrown on the etiology of this disease by a study of sanitary conditions, effect of climate, age and sex, length of residence, occupation, food or water supply, &c. It is therefore necessary to turn to the laboratory to see if anything can be discovered from a study of the micro-organism which causes the disease. The *Micrococcus melitensis* has been described so often that it is not necessary for me to do so. Suffice it to say that it is very minute, that it grows outside the body on artificial media, and that it can be distinguished from other micro-organisms by suitable tests.

The members of the Commission entrusted with the laboratory work set themselves to study how this micro-organism leaves the body, how it behaves outside the body, and how it is able to again gain entrance to the body.

How does the Micrococcus melitensis *Leave the Body?*—It is important, of course, to find out how a parasite leaves the body, as this may throw light on the mode of infection. Many experiments were made to try to discover it in the expired air, in the saliva, expectoration, sweat and scrapings of skin of patients, and finally it was decided that the principal path by which this micro-organism leaves the body is by way of the urine. It is true it also leaves the body in small numbers by way of the blood, by the agency of mosquitoes and other biting insects, and this led to the idea that infection might take place in this way. The urine sometimes contains the Micrococci in enormous numbers, but as a rule they are scarce, ranging from three or four to as many hundreds per cubic centimetre. The Commission examined several thousand samples and found the micrococcus in 10 per cent. This excretion of the

parasite in the urine, taken in conjunction with its resistance to drying, was looked upon by the Commission as a very probable factor in the spread of the disease, and many experiments were made on this hypothesis.

Life of the Micrococcus melitensis *Outside the Body. Vitality of the Micrococcus.*—Many experiments were made by the Commission, the results of which went to show that this micro-organism is fairly resistant to external influences. It can exist in a dry condition in dust or clothing for two to three months. It lives in tap-water or sea-water for about one month. Even in urine which has decomposed and become markedly alkaline it can live for a week. Exposure to direct sunlight kills it in a few hours.

Habitat of the Micrococcus Outside the Human Body.—Many attempts were made to discover this parasite outside the body. As the theories in vogue named insanitary conditions, sewer air, dust from infected places, the water of the harbour, &c., as causing this fever, diligent search was made in every likely place to discover this microbe, but up to the present with no success.

How does the Micrococcus Gain Entrance to the Body?—It is on finding the correct answer to this question that the success of an investigation such as this probably hangs. Does the parasite gain entrance by way of the alimentary canal, by the lungs, through mucous membranes, or through the skin? In other words, is it conveyed from the sick to the healthy by means of food or drink, by contaminated dust, or by blood-sucking insects?

In trying to find out a means of stamping out a disease, it is important to try to narrow down the paths of infection. As long as yellow fever was thought to be spread by contact, infected clothes, food, water, &c., nothing could be done. As soon as it was discovered that it was spread by a particular species of mosquito the problem of prevention was simple. In the same way in Malta fever: if it can be spread by contact, contamination of food or water, by the inhalation of dust, sewer air, &c., it will be impossible to do more than recommend the ordinary established rule of hygiene. But, on the other hand, if the mode of spread can be narrowed down to some one path, then stamping out the disease becomes possible. Let me, then, shortly discuss the experiments made by the Commission to solve this question.

By Contact.—This is important, as questions of segregation, evacuation and disinfection of barracks depend on this mode of infection. Experiments were made by placing monkeys in more or less intimate contact, and it was found that if the contact was

quite intimate infection does take place. If, on the other hand, the contact is less intimate, so that contamination of the food by infected urine was prevented, infection did not take place. It was concluded that monkeys probably took the disease by having their food contaminated by the urine of their sick neighbours, and that therefore contact resolved itself into a feeding experiment. As it is very unlikely that man has his food so grossly contaminated as in the case of the monkey, it is improbable that infection takes place, except very rarely, in this way.

In regard to this question of conveyance by contact, there is one argument against it which seems to me unanswerable, and that is that thousands of cases of Malta fever have been invalided home to England and treated in our naval and military hospitals, without, as far as I am aware, a single case of the fever arising among the patients, orderlies, or nursing sisters. We may, therefore, conclude that contact with Malta fever patients, or the handling of infective clothing or discharges, is not the path by which the Micrococcus gains entrance to the body.

By Dust Contaminated by the Micrococcus melitensis.—For some time it was considered probable that this would prove to be the common method of infection. The fact that the Micrococcus withstands drying for a long time, the dusty nature of Malta, and the probability that gross contamination of the surface of the soil takes place by infective discharges, rendered this view likely.

Experiments were made to put the theory to the test. Dust was artificially contaminated with Micrococci and blown about a room in which monkeys were confined, or blown into their nostrils or throat. Several of these experiments were successful. It was therefore proved that dust artificially contaminated with *Micrococcus melitensis* could give rise to the disease. This, however, was no proof that this mode of infection occurs in Nature. The artificially-contaminated dust contained myriads of Micrococci. Under natural conditions they could seldom be numerous, and the powerful Maltese sunlight would tend to kill them off rapidly. The dust blown about by the wind must also dilute the Micrococci to an enormous extent, so that it is only possible to conceive of a Micrococcus here and there in a vast quantity of dust. Experiments were therefore made with dust contaminated with urine, in order more closely to resemble natural conditions. The Commission made many experiments on these lines, but in no case with a successful result. Dust collected from suspicious places and blown about the cages, sprinkled on food or injected under the skin, also gave negative results. The

conclusion was therefore come to that conveyance of the infective germ by means of contaminated dust could only rarely, if ever, give rise to the disease.

By Way of the Alimentary Canal.—As it is most important to ascertain, without the shadow of a doubt, whether an infective micro-organism can enter by way of the alimentary canal, many feeding experiments were made. It had long been known that the smallest quantity of the Micrococci introduced under the skin, or applied to a scratch, would give rise to the disease in man and monkeys, but some previous work had cast doubts on infection by the mouth.

I need not bring the details of these experiments before you, but will only state that it has been abundantly proved that Malta fever can be conveyed to healthy animals by way of the alimentary canal. Even a single drink of fluid containing few Micrococci almost certainly gives rise to the disease.

By Mosquitoes or other Biting Flies.—As already mentioned, the theory had been advanced that Malta fever, like yellow fever and plague, might be conveyed by blood-sucking insects. The fact that the Micrococci are frequently found in the peripheral blood, although, it must be confessed, in very small numbers, gave some colour to the belief. The Commission, therefore, fully investigated this question and made numerous experiments with the different species of mosquitoes found in Malta, and also with other blood-sucking insects.

The results went to show that this mode of conveyance of the Micrococci from sick to healthy animals, if not absolutely negatived, can only be of the rarest occurrence.

Up to this point, then, the Commission had shown, by experiment, that the most probable way the Micrococcus gained an entrance to the body was by the alimentary canal, and therefore by some infected food or drink. There was no evidence that contact, inhalation of infective dust, or mosquitoes, play any prominent *rôle*. But, on the other hand, the epidemiologists could see no reason for suspecting the water supply or any particular food-stuff.

Infection by Means of Goats' Milk.—At last a discovery was made which threw a flood of light on the obscurities and seemed to explain the epidemiological features of the disease. This was the remarkable discovery that the goats in Malta act as the reservoir of the virus of this fever. The discovery came about in this way. In an investigation of this sort it is part of the work to examine the various surrounding animals to find out if any of them are suscep-

tible to the disease. The monkey was the only animal which was known to take the disease naturally, although some of the laboratory animals, such as the rabbit and guinea-pig, could be made to take the infection by various expedients, such as, for example, intracerebral inoculation. In this way the goat came under observation. The goat is very much in evidence in Malta and supplies practically all the milk used. Flocks of them wander about the streets from morning till night and are milked as required at the customers' doors. It must be confessed the Commission had little hope that an examination of these animals would yield anything. As a matter of routine several goats were inoculated with the Micrococcus and the result watched. There was no rise of temperature, no sign of ill-health in any way, but in a week or two the blood was found to be capable of agglutinating the specific micro-organism. Even then, the goat seemed such an unlikely subject for Malta fever, the observation was in danger of lapsing. Nothing more was done for several months, when by accident the matter came up again, and it was decided to repeat the inoculation experiments. A small herd was procured for the purpose, and, as an ordinary precautionary measure, their blood was examined before inoculation. Much to the surprise of the Commission, several of them were found to react naturally to the agglutination test, and this led to the examination and the discovery of the *Micrococcus melitensis* in the blood, urine and milk. Some thousands of goats in Malta were then examined, and the epoch-making discovery was made that 50 per cent. of the goats in Malta responded to the agglutination test, and that actually 10 per cent. of them were secreting the Micrococci in their milk. Thus the long and tedious investigation of this fever was beginning to bear fruit. Monkeys fed on milk from an affected goat, even for one day, almost invariably took the disease. At this time, curiously enough, an important experiment on the drinking of goats' milk by man took place accidentally. This is the case of the s.s. "Joshua Nicholson," which has been fully described by Staff-Surgeon Clayton, R.N., in vol. vii. of the Reports of the Commission. Shortly, the story is as follows: In 1905 the s.s. "Joshua Nicholson" shipped sixty-five goats at Malta for export to America. The milk was drunk in large quantities by the captain and the crew, with the result that practically everyone who drank the milk was struck down by Malta fever. There is no need for me to go into the details, as these can be read in the report. I may add, however, that sixty of the goats (five having died) on arrival in America were examined and thirty-two

found to give the agglutination reaction, while the *Micrococcus melitensis* itself was isolated from the milk of several of them.

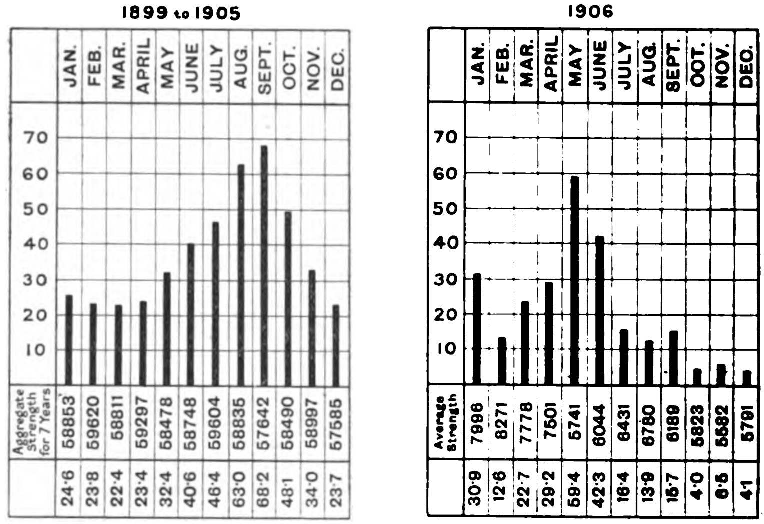
This epidemic of Malta fever on board the "Joshua Nicholson" furnishes, in my opinion, the clearest proof possible of the connection of Malta fever in man with the Maltese goat.

Another proof of this connection is given by Major Horrocks, R.A.M.C., the Sanitary Officer at Gibraltar, and published in vol. v. of the Reports. Twenty years ago Malta fever was very common in Gibraltar, but since that time the incidence has gradually lessened, until it finally disappeared completely in 1904. Horrocks has made the curious and important observation that this disappearance of Malta fever from Gibraltar is associated with the disappearance of the Maltese goat. He says that in 1883 practically all the goats on the Rock were Maltese, and at that time regular shipments of goats from Malta to Gibraltar took place. *Pari passu* with the withdrawal of grazing passes, and the increase in the cost of shipment, the importation of goats from Malta ceased, and goat-keepers replaced their stock partly by importation of Spanish goats and partly by breeding.

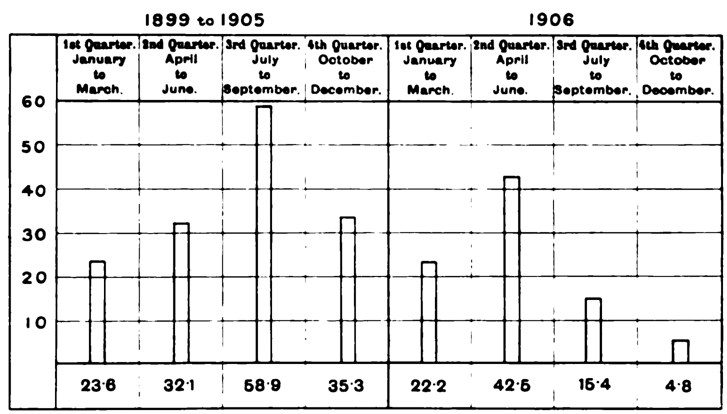
Here, then, at last, has been discovered a mode of infection which explains many of the curious features in the epidemiology of Malta fever—the irregular seasonal prevalence, the number of cases which occur during the winter months, when there are no mosquitoes and little dust. It is true there are more cases in summer, but this may be explained by the temperature being more favourable for the multiplication of the Micrococcus in milk that has been set aside, and to the fact that more milk and cream is used for fruit, in ice-creams, &c. It explains the liability of the officer to attack being three times as great as in the case of the private soldier, since the former consumes much more milk in various ways than the latter. It also explains the isolated epidemics which sometimes occur at any season of the year in institutions or in messes, such as that published by Dr. Johnstone in vol. ii. of the Reports of the Commission, where a sergeants' mess was severely struck, while the men living in the vicinity escaped.

Result of Measures directed against the Use of Goats' Milk.—Preventive measures, as a result of this enquiry, were first begun in Malta in June, 1906. Of course, much opposition and prejudice were met with at first, but by dint of argument and explanation most of the regiments and military and naval hospitals agreed to banish goats' milk from their dietary. The result is very striking,

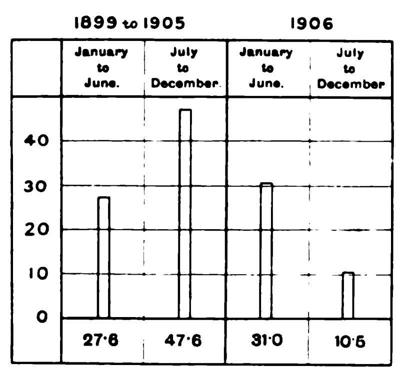
MONTHLY PREVALENCE RATIO PER 1,000 OF STRENGTH, EXPRESSED IN TERMS OF AN ANNUAL RATIO.



QUARTERLY PREVALENCE.



HALF-YEARLY PREVALENCE.



as is shown by Majors McCulloch and Weir, in the accompanying charts, which give the number of cases of Malta fever among the soldiers in the garrison before and after the preventive measures came into action.

The preventive measures, it must be repeated, only came into practical use about the beginning of July, 1906, and a remarkable diminution in the incidence is at once seen. Broadly speaking, the cases dropped to one-tenth of what would have been their normal number. It will also be noted that 1906 began badly, there being an average incidence of 31·0 per 1,000 for the first six months, against 27·6 per 1,000 for the years 1899 to 1905.

Another striking example of the benefit of this simple preventive measure is given in the case of the Royal Naval Hospital, Malta. This hospital is a fine modern building, situated in extensive grounds, surrounded on three sides by the sea, with excellent drainage and water supply, and beautifully kept. In spite of these advantages this hospital has been in bad repute for years on account of the number of cases of Malta fever which broke out among its inmates. According to Staff-Surgeon Clayton, who enters very fully into this question in his report, one-third of the cases of Malta fever which occur in the Navy can be traced to residence in this hospital. The goats supplying the hospital with milk were examined and several of them found to be excreting the Micrococcus in their milk. Goats' milk was forbidden, and from that date not a single case has occurred or can be traced to residence in this hospital.

Taking all these facts and arguments into consideration there is, I think, reasonable ground for the hope that Malta fever will now disappear from the garrison in Malta, and some 70,000 or 80,000 days of severe illness be blotted out from the yearly medical reports of the Army and Navy. This much to be desired result, which, in my opinion, must come off if the Maltese Government only take the necessary simple measures, will change Malta from one of the unhealthiest and most dangerous stations of the British Army to one of the most salubrious; and you will agree with me that the Royal Society and the members of the Commission are to be congratulated on the successful issue of the investigation.

COMMON ULCERS OF THE CORNEA AND THEIR TREATMENT.

By Lieutenant H. H. B. CUNNINGHAM.
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Ulceration has been defined[1] as "a progressive destruction of the tissues in which the solid parts seem to melt away into a liquid discharge without the separation of visible portions of dead tissue." This is a condition we frequently observe in the cornea, especially in those cases which do not readily respond to treatment, and is to be distinguished from an abrasion, which is a loss of substance, the result of traumatism, but in which there is no inflammation, though this may, and frequently does, occur subsequently. Ulcers of the cornea, at times called superficial keratitis, are many and various, as will be at once recalled on perusing a classification such as this, a slight modification of that adopted by Juler,[2] viz.:—

(1) *Primary Keratitis.*—(*a*) Simple superficial ulcer; (*b*) phlyctenular keratitis; (*c*) fascicular keratitis; (*d*) herpes cornea; (*e*) dendritic keratitis; (*f*) filamentary keratitis; (*g*) bullous keratitis; (*h*) rodent or Mooren's ulcer; (*i*) suppurative keratitis, including ulcus serpens; (*j*) neuroparalytic keratitis; (*k*) keratitis e lagophthalmo.

(2) *Secondary Keratitis.*—(*a*) Secondary to conjunctival affections, *e.g.*, catarrhal granular or purulent conjunctivitis; (*b*) secondary to affections of the lids, *e.g.*, entropion trichiosis; (*c*) or following on a previous disease, *e.g.*, an atheromatous ulcer developing in an old glaucomatous eye.

It is only the phlyctenular and suppurative forms of keratitis which, forming the largest percentage of this type of affection met with in our practices, this paper deals with. Before discussing them, let me briefly recall the structure of the cornea. It is described as consisting of four layers, viz.: (1) The anterior stratified epithelium; (2) the substantia propria, including Bowman's membrane; (3) Descemet's membrane; (4) the posterior epithelium.

The anterior epithelium is the continuation of the conjunctiva over the substantia propria. Bowman's membrane was formerly

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[1] "Science and Art of Surgery," Erichsen, vol. i.
[2] "Ophthalmic Science and Practice," Juler, p. 120.

described as a separate elastic layer, but now it is considered to be the anterior homogeneous layer of the substantia propria; which latter structure is continuous with the sclerotic, and contains between its lamellæ a number of lacunar spaces, freely connected with each other in the planes and through the bundles; by means of this, the lymph system of Recklinghausen, the nutrition of the cornea is maintained, for there are normally no blood-vessels in the structure. Descemet's membrane or the posterior elastic lamina is the immediate posterior relation of the substantia propria, and is continued at the circumference of the cornea into the ligamenta pectinata. The dimensions of the cornea are about 11 mm. vertically, 12 mm. horizontally, 0·8 mm. thick, except towards the periphery, where the thickness increases to about 1·1 mm. Now a loss of substance in the epithelium can be replaced by regenerated epithelial cells, but should the ulcer have extended through Bowman's membrane, eroding the substantia propria, then the gap thus formed can only be filled up by scar tissue, for the corneal lamellæ do not regenerate. And this scar tissue is more fibrous[1] and so more noticeable after inflammations than that resulting from wounds. So in treating these cases it behoves us to do so in such a manner that the eye recovers with the least possible amount of damage to the corneal tissue. For we must remember in answering the oft-repeated question, "Will it hurt the sight?" that the larger the ulcer is the greater will be the amount of scar tissue necessary to replace the loss of substance, and therefore the larger will be the resulting nebula, which will interfere with and distort the rays of light in their path to the retina. These forms of keratitis have several symptoms in common, the intensity of which varies in different cases, viz., pain, photophobia, giving rise to more or less blepharospasm, lachrymation and injection of the conjunctiva, and which are fraught with much distress to the sufferer, recalling to our minds the words of Warburton: "Of all the distressful calamities to which man's life is subject sickness is the most afflictive."

Phlyctenular keratitis is most frequently met with in children, though it is occasionally seen in young adults, and the sufferers are nearly always of that debilitated type which was formerly designated strumous. The ulcer results from a phlyctenula, itself the consequence of an embolus[2] of dead tubercle bacilli being carried to the

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[1] "Pathology of the Eye," Parsons, vol. i.

[2] *Transactions of the Ophthalmological Society*, vol. xxvi., p. 243.

margin of the cornea, and which, possessing some toxin in a low form of virulence, causes the formation of the phlyctenula in the cornea, rupturing and exfoliating its outer wall, which probably consists of corneal epithelium, for the vesicle is stated by some authorities to be situated on Bowman's membrane, by others to be deep to that structure; the ulcer appears as a definite, more or less circular, loss of substance in the cornea, its size varying in each individual case. These ulcers, individually, are amenable to treatment, and when healing a leash of vessels is usually observed extending from the conjunctiva to the ulcer. But difficulty arises from the fact that they recur, a fresh one frequently appearing shortly after recovery from the previous one. Recently, some work has been done on the opsonic index[1] to tubercle in these cases, which shows that the index varies considerably in different cases, being frequently normal. In the writer's cases in which the index has been taken it has been found normal in each case.

The treatment to be adopted is general more than local, for it is the health of the patient that is at fault, the sufferer being frequently an underfed or improperly-fed child, who spends a good deal of its time indoors, and often sleeps in a small, badly-ventilated room, with two or three other persons. Therefore we prescribe plenty of fresh air, exercise in the open air and in the sunshine as much as possible, plenty of good food and a tonic, such as cod-liver oil, syrup of iodide of iron, or syrup of phosphate of iron. The local treatment consists in bathing the eye frequently with a simple lotion, boracic being that most frequently used, instilling a little atropine, and keeping a pad over the eye, with a light bandage. But some surgeons prefer simply dusting calomel on the eye; this occasionally causes some irritation to the eye, if the powder is not pure; while others content themselves with applying atropine; dionine[2] also has its advocates, and certainly great benefit frequently results from its use; while others advise counter-irritation, by applying iodine or a seton to the temple.

The value of the general treatment is shown by this case: A child who had been attending as an out-patient for three months with this affection, and which was complicated by the ulcer having become septic, and who showed no sign of recovery, was admitted to hospital, where she naturally obtained the benefit of good food

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[1] *Transactions of the Ophthalmological Society*, vol. xxvi.; *Lancet*, December, 1906, Paton and Nias.

[2] *British Medical Journal*, May 12th, 1906, Henshelwood.

and hygienic surroundings. Virol in dram doses was given as a tonic, and locally warm boracic lotion and atropine ointment were applied, with the result that in ten days she was discharged cured, and the ulcers completely healed up.

Unfortunately, these ulcers frequently become infected, and then the disease assumes that more severe condition which forms the other type of ulcer to be discussed in this paper, viz., primary suppurative keratitis, which appears as a definite, more or less circular, loss of substance on the surface of the cornea, the edges and floor of which are opaque, owing to the presence of leucocytes and pus corpuscles. This condition is met with in two forms : (1) A form of ulceration which results from infection by various micro-organisms, of an abrasion of the cornea, such as that caused by traumatism, or of a ruptured vesicle occurring in a debilitated subject. This type is usually met with in the young, but may be seen at any age, especially amongst those whose employments expose them to injuries of the cornea. (2) That type described by Saemisch, in 1870, as ulcus serpens, owing to its tendency to creep over the surface of the cornea, and called by the older writers hypopyon ulcer. The sufferers from this ulcer, however, are usually elderly persons, broken down in health and with feeble recuperative power. Parsons[1] states that the consensus of opinion on the formation of this ulcer is that it commences as an infiltration of the superficial epithelium at the centre of the cornea, which goes on to destruction and disintegration of the cells, thus forming the ulcer, which by spreading peripherally and deeply will cause great destruction of the corneal tissue, and which by eroding the cornea will perforate through into the anterior chamber, and then by direct extension to the iris and ciliary body set up panophthalmitis, and so loss of the eye. In illustration of this, an elderly woman presented herself at the hospital with a large septic corneal ulcer in the right eye. She was taken in, the eye gently bathed with boracic lotion and a pad and light bandage applied. Next day, on removing the bandage, it was seen that the cornea had elongated and the lens had been extruded and was adhering to the dressing, and panophthalmitis had set in. A concomitant condition of this ulcer, and occasionally of an affected ulcer when of a severe type, is the presence of a purulent-looking material, consisting of a fibrinous coagulum, laden with leucocytes, in the anterior chamber, known as hypopyon. This being sterile is not true pus, and it is

[1] "Pathology of the Eye," Parsons, vol. i.

on account of the presence of this material that the condition used to be called "hypopyon ulcer." The micro-organisms responsible for these ulcers[1] are streptococci, bacilli, &c., which may be associated with one another or with the pneumococcus. But in the case of ulcus serpens, Uhthoff and Arenfeld,[2] in 1896, showed that the *Pneumococcus lanceolatus* of Fraenkel was the main cause, it being most frequently found alone,[3] or else mixed with other micro-organisms. In these ulcers the usual symptoms may, or may not, be as marked as one would expect; but in addition there is often œdema and hyperæmia of the lids, with some chemosis. The treatment of this severe affection must be energetic; a good aperient is administered, then the lachrymal sac is to be examined to see if therein should be the source of the infection. Bathing the eye with a weak antiseptic lotion is of great value, for it soothes the inflamed member and washes away the *débris*. Various lotions are in use for this purpose. Sulphate of quinine is recommended by Lawson,[4] weak perchloide of mercury has its advocates, and boracic lotion used warm frequently gives good results. Atropine is instilled into the eye for the twofold purpose of giving it physiological rest and of preventing adhesion of the iris to the cornea should the ulcer perforate. Hot fomentations are useful in causing an increased blood flow, which will dilute the toxins. Should there be much pain and signs of iritis two or three leeches to the temple give marked relief. Dusting the ulcer with iodoform powder is well spoken of. Should the keratitis not soon yield to the treatment, and the hypopyon be increasing, then the ulcer itself, the focus of the disease, must be attacked, with the hope of destroying the micro-organisms contained in it. This can be conveniently effected by cauterising it, for which purpose we have three agents, viz., absolute alcohol, pure phenol, and the actual cautery, and it is the last-named which, being the most powerful, gives the best results, the action of which is well described by Ovio.[5] The cautery, at a dull red heat, should be made to lightly touch the edges and floor of the ulcer, then atropine instilled and a pad and a bandage applied. The effect of the

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[1] "Pathology of the Eye," vol. i., p. 213, Parsons.
[2] *v. Graefe's Archiv. fur Ophthalmologie*, xlii., 1, 1896, Uhthoff and Arenfeld.
[3] *Annali di Ottalmologia*, vol. xxxv., fasc. 1-2, E. Salveneschi.
[4] *Transactions of the Ophthalmological Society*, vol. xxv.
[5] *La Clinica Oculistica*, November, December, 1905, January, 1906, G. Ovio; *Annali di Ottalmologia*, vol. xxxv. (1906), fasc. 1-2, pp. 58-64, G. Ovio.

cautery can frequently be enhanced if subsequent to its application a paracentesis of the anterior chamber be performed. One has frequently seen cases of septic corneal ulcer that have resisted ordinary measures for days rapidly recover after one application of the cautery. The value of paracentesis is well illustrated by the following case: A patient, aged 16, suffering from an infected ulcer, who had been treated for three months with lotions, atropine, eserine and the cautery, but all to no purpose, was finally admitted to hospital and paracentesis performed. Seven days later the ulcer was healed. A method of treatment for these ulcers that is rarely employed nowadays is that known as Saemisch section, yet recently one performed this operation in a patient suffering from a large septic ulcer, with a hypopyon filling half the anterior chamber, which absolutely resisted treatment, evacuating only half the so-called pus, yet next morning there was no sign of hypopyon and the anterior chamber had reformed, the ulcer appeared cleaner, and was completely healed a week later. After paracentesis absolute quiet is advisable to rest the eye and give it the full value of the relief from tension. As a general rule the condition of the eye will now rapidly improve and the ulcer heal up, leaving more or less of a nebula as a permament monument of its destructive power. But in those unfortunate cases in which, in spite of all our treatment, the ulcer continues its wayward course, finally inflicting on the sufferer that hopeless condition, panophthalmitis, we are forcibly reminded of Shakespeare's words:—

> Diseases desperate grown
> By desperate appliance are relieved or not at all;

for we have only the last resource of surgery, namely, enucleation, to perform.

THE PREVALENCE OF BLACKWATER FEVER IN THE BAHR-EL-GHAZAL.

By Captain HOWARD ENSOR, D.S.O.
Royal Army Medical Corps.

The Bahr-el-Ghazal district, one of the most southerly provinces of the Anglo-Egyptian Sudan, can be roughly said to be contained between lat. 4° and 9° N., and long. 25° and 31° E., and to be bounded on the north by the Bahr-el-Arab River, on the south by the watershed between the tributaries of the Nile and Congo and that part of the Bahr-el-Ghazal district which is at present leased to the Congo Free State, the Lado Enclave, on the east by the White Nile, and on the west by the French Congo.

The indigenous population is made up entirely of negro or negroid races, the Dinka tribes being the most numerous in the north of the district, while the Nyam-Nyam or A'Zandi race comprise the bulk of the population in the south. All these indigenous races appear to be quite immune to blackwater fever.

The permanent European and Egyptian population during the past twelve months, from October 1st, 1905, to September 30th, 1906, is estimated, for the purposes of this article at 180 men.

The European population numbers about forty, being made up of about sixteen British officers serving with the Egyptian Army, twelve priests belonging to the Sudan Catholic Mission, and not more than a dozen traders, the majority of the priests and traders being of Italian and Greek extraction.

The Egyptian population is made up of the Egyptian officers and men serving in the district, and the civil employees of the Sudan Government; some of these last are, however, really Asiatics, being of Syrian birth and education. This population numbers about 140 men. Under the term "Egyptian population" is also included several persons of mixed Egyptian and Sudanese blood. It may be mentioned here that, with the exception of the Egyptian officers serving with Sudanese battalions, and the Egyptian officers and men of the detachment medical corps doing duty in the district, no Egyptian troops regularly serve in the Bahr-el-Ghazal, owing to prevalence of malarial fevers, to which the Egyptians are peculiarly liable.

From the above it will be seen that the combined European and Egyptian population comes up to the number of 180 men. It is

among these that the cases of blackwater fever occur, the natives, as has been before mentioned, being immune to this disease. It is, of course, well known that Europeans are liable to blackwater fever, but it is perhaps not generally known that Egyptians, Syrians, and people of mixed Egyptian and Sudanese blood are as liable, if not more so, to this disease as Europeans. It has been stated by certain authorities that the black races themselves are not immune to blackwater fever, if they happen to have been born and bred in districts free from this disease. This may be true of some parts of Africa, but my experiences in the Bahr-el-Ghazal certainly lead me to an entirely opposite view, namely, that, as far as the Anglo-Egyptian Sudan is concerned the black races are immune to blackwater fever. Many of the Sudanese troops serving in the Bahr-el-Ghazal are, indeed, related by blood to the indigenous tribes dwelling within it, but the great majority of them have been born and have grown to manhood in the northern provinces of the Anglo-Egyptian Sudan, where blackwater fever has not yet been proved to exist, and a strong minority of our Sudanese troops are by birth natives of Egypt, the descendants of the thousands of negroes who were formerly held as slaves everywhere in Egypt. In addition to the Sudanese troops, hundreds of blacks from Omdurman and Khartoum, towns where blackwater fever, or, for that matter, tropical diseases, are uncommon, come up to the Bahr-el-Ghazal every year in the capacity of servants, labourers, transport drivers, &c., and from the Sudanese troops and these men, all of whom come under our observation when sick, not a single case of blackwater fever has occurred during the last twelve months, and neither is there any record of any case having occurred in a man of pure Sudanese extraction. These men are certainly not immune to malarial fevers, and, indeed, suffer frequently from fevers of this type during their first six or eight weeks of residence in the Bahr-el-Ghazal, after which period they appear to enjoy a degree of immunity far in excess of that ever acquired by Europeans or Egyptians. It is with much diffidence that my experiences concerning the immunity of Sudanese who have been born and grown to manhood in districts where blackwater fever is not endemic, have been here put on record, especially as such authorities as Phlen and Sambon hold a different belief on this point; but at any rate, this is my opinion, based on a year's residence in a district where blackwater fever is far from uncommon.

The following tables give the number of cases of blackwater fever which have occurred in the Bahr-el-Ghazal district for a period

of twelve months, from October 1st, 1905, to September 30th, 1906, from the military and civil population respectively.

TROOPS AND CIVIL GOVERNMENT EMPLOYEES.

Station	Month of the year	Number of cases	Remarks	Result
Wau ..	October, 1905 ..	1	An Egyptian soldier	Recovery.
,, ..	November, 1905..	1	An Egyptian officer	,,
,, ..	January, 1906 ..	1	A civilian employed as postmaster—a man of mixed Egyptian and Sudanese blood	Death.
Rumbek	April, 1906 ..	1	An officer of mixed Egyptian and Sudanese blood	Recovery.
Wau ..	May, 1906 ..	1	An Egyptian warrant officer ..	,,
,, ..	June, 1906 ..	3	Egyptian soldiers	,,
,, ..	July, 1906 ..	2	,, ,, ...	,,
,, ..	September, 1906..	1	An Egyptian soldier	,,

CIVIL POPULATION.

Station	Month of the year	Number of cases	Remarks	Result
Wau ..	November, 1905..	1	An Italian priest	Death.
,, ..	December, 1905..	1	An Austrian priest	Recovery.
Mabilli ..	June, 1906 ..	1	An Italian priest	Death.
Kyango ..	August, 1906 ..	1	,, ,, ...	,,

From the above tables it will be seen that fifteen cases of blackwater fever occurred altogether, and that of this number four were fatal, making the total percentage of fatalities as 26·6, while of the whole population liable to be attacked by blackwater fever, in number about 180, 8·3 per cent. acquired this disease. In fairness, however, to the medical staff of the district, it must be mentioned that it is hardly just to include the priests of the Sudan Catholic Mission in the above statistics. These brave and devoted men, until recently, frequently stayed more than two years without change of air to a healthier climate, and have no medical service whatever of their own, although two of their stations, Mabilli and Kyango, are twenty-five and forty-five miles distant from Wau, the only place from which they can get medical assistance. Two of the three fatal cases recorded from among the members of this Mission occurred at these two out-stations; the case which was acquired at Mabilli was moribund on the arrival of a medical officer sent out to look after him, and died two or three hours after his arrival; the other, which occurred at Kyango, was in the person of a priest who had been two years

in the district without change of air, and who, in addition to having suffered, according to his own statement, from a mild attack of blackwater fever some time during the previous year, was also said to be suffering from chronic nephritis. This priest died of suppression of urine, which in view of his previous history was not in any way surprising. These priests also seem to have very little knowledge of sanitation, or of how to preserve their health in a tropical country, and are in consequence much debilitated from repeated attacks of malarial fevers, which they only recently have begun to avoid by taking prophylactic doses of quinine. On account of this it is perhaps only fair that the priests should not be included in working out the percentages of mortality from blackwater fever during the past year, from October 1st, 1905, to September 30th, 1906. If this is allowed the rate of mortality falls to 1 in 11, or 9·09 per cent., which is perhaps what the death-rate from this disease ought not to exceed in properly treated cases under favourable conditions. It must also be stated that up to the present the conditions under which the European and Egyptian populations have been living cannot be described as favourable, as no permanent buildings, hospitals, &c., have been yet completed. They are now, however, in process of construction, and it may with confidence be expected that not only will the number of cases of blackwater fever diminish, but that the case-mortality will also decrease when these buildings are completed.

The treatment adopted in all the eleven cases which occurred among the troops and civil employees was of the symptomatic variety, and no quinine whatever was given, with the result that only one case was fatal, which result will be considered very satisfactory by physicians to whom this disease is familiar.

It will be seen from the tables that out of all the cases which occurred they all, with one exception, occurred at Wau, or in the near vicinity of that station. The exception which is recorded took place at Rumbek in the month of April, a station 160 miles south-east of Wau. No authentic cases occurred at any of the other out-stations of the district. It should not, however, be concluded from this that blackwater fever is practically confined to Wau, and that the out-stations are free from it. Wau is the headquarter station, and contains far more of the population liable to this disease than any of the other out-stations, and it is probably on this account that Wau presents the majority of cases of blackwater fever. When down on the Congo Free State frontier in the beginning of last year an opportunity was given me of questioning some of the Belgian

officers concerning the prevalence of this disease in their territory, and they informed me that it was far from uncommon. This information must, however, be accepted with caution, as they do not appear to have any properly organised medical corps, if they have one at all on the frontier, and it is always best to be careful about accepting the statements of non-medical men concerning the prevalence or otherwise of blackwater fever.

The Bahr-el-Ghazal district was partially reoccupied by the Egyptian troops in the year 1900, and one or two cases were recorded soon afterwards, but there does not appear to be any certain record of more than five or six cases altogether having occurred from the year 1901 to the end of September, 1905. This district, which has now been fully reoccupied, was, previous to the rebellion begun by the Mahdi and carried on by the Khalifa Abdullah, well known to Europeans, as the writings of Schweinfurth and Gaetano Casati testify; but in their books, which, however, I cannot pretend to have very closely studied, no mention of a disease resembling blackwater fever is made, and this must be my apology for writing this article, as I do not think that the existence of blackwater fever in this part of Central Africa has ever yet been sufficiently put on record.

THE BACTERIOLOGY OF WATER-BOTTLES; WITH THE DESCRIPTION OF ONE OF A NEW PATTERN.

By Major NORMAN FAICHNIE.
Royal Army Medical Corps.

In a paper by me, entitled "Enteric Fever: A Water-Borne Disease," which appeared in the May number of this Journal for 1906, stress was laid on the fact that the poison of enteric fever could survive for some time in water pipes or storage vessels that had once been polluted. The subject is one of great interest in connection with the fact that, according to some, before enteric fever can occur a pre-existing case must have been present. If 1,000 men, pronounced free of enteric fever after the most careful bacteriological examination, were allowed to pollute their drinking-water with their excreta, one cannot help thinking that they would still get enteric fever, although no specific origin for the disease could be traced. But even if the *de novo* origin of this disease be not admitted, if storage vessels are liable to remain polluted for some time we have at once a cause for enteric fever occurring in out-of-the-way places, where previous cases seemed impossible, and where the cause has seemed to be a mystery.

The following experiments made by me during the last six months seem to show that infection in this way has long been a common factor in the causation of this disease. These experiments have been made on the lines of the routine bacteriological examination of water, which consists in adding water to bile salt broth coloured blue by neutral litmus, and having a Durham's tube at the bottom to show the presence of gas; the water is incubated for twenty-four or forty-eight hours. If the broth remains blue no intestinal organisms are present; if, however, intestinal organisms, which include *B. typhosus*, *B. coli*, *B. dysenteriæ* and *Vibrio choleræ asiaticæ*, are present, it becomes acid, with or without the formation of gas, according to the nature of the organism or organisms present. When it is stated that *B. coli* was found, by that is meant an organism which was slightly motile and did not stain by Gram, and which also gave the "flaginac" reaction of Houston, viz: (1) fluorescence with neutral-red media; (2) acid and gas with litmus lactose broth; (3) indol in five days on the addition of commercial nitric acid; (4) acid and clot with milk in forty-eight hours.

(1) *Examination of wooden water-bottles.*—These are of an old pattern, and form part of the equipment of most Militia battalions. They are about twenty years old, and between the trainings are kept in store at the Militia depôts. The examination consisted in adding sterile water, which was left in the bottle for twenty-four hours; at the end of that time 5 cc. were taken out and examined.

(*a*) Two bottles from Preston: both gave acid and gas reaction with bile salt broth. *B. coli* not found. Control remained unchanged; (*b*) eleven bottles from 5th Battalion Northumberland Fusiliers: all gave acid and gas reaction. From three *B. coli* was separated. In addition, two gave all the reactions of *B. coli*, except fluorescence with neutral-red broth. Control remained unchanged; (*c*) ten bottles from 3rd Battalion York and Lancaster Regiment: nine gave acid and gas reaction, one gave acid only. Control remained unchanged. *B. coli* isolated from two of these bottles; (*d*) six bottles from 4th Battalion the Yorkshire Regiment: five gave acid and gas reaction; one remained unchanged. Control unchanged; (*e*) twelve bottles from 3rd Battalion the Lincolnshire Regiment: ten gave acid and gas; one gave acid only; one remained unchanged. Control unchanged; (*f*) six bottles from Royal Army Medical Corps Militia, York: four gave acid and gas; one gave acid; one remained unchanged. Control unchanged.

No attempt was made to isolate *B. coli* from the last three sets of bottles. The great majority of these bottles had had no chance of being contaminated since the last training, so they must have been polluted for over a year. On inquiry I found that these bottles are seldom, if ever, used by the men.

(2) *Examination of enamelled iron bottles of circular pattern.*—

a) Twelve bottles obtained from the Ordnance Department: all sterile as regards intestinal organisms; (*b*) three bottles from Royal Army Medical Corps, York: two sterile; one gave acid reaction; (*c*) five bottles from Lichfield: three remained unchanged; one gave acid and gas, but no *B. coli;* one gave acid and gas, and *B. coli* was separated.

The last bottle belonged to a man who was suffering from enteric fever; there was a clear history, however, that he had not used it, as he had not been able to get the cork out since it was issued to him, so it must have been polluted for at least a year.

(3) *Experiments with enamelled iron water-bottles of circular pattern.*—

(*a*) *January* 15*th.*—A sterilised bottle was filled with impure water taken from the Ouse near the entry of a drain, and left for two and a half months.

April 5*th.*—Impure water thrown out, sterile water put in and shaken

up. After a sample was taken for examination, this water was thrown out and fresh sterile water added, and this process was repeated four times in succession in the space of ten minutes.

Result :—Original impure water; acid and gas. First, second, third and fourth washings, acid and gas. Control of sterile water unchanged.

April 6*th*.—Bottle washed out twice consecutively with fresh sterile water. Fifth and sixth washings, acid and gas. Control unchanged.

April 19*th*.—Bottle washed out three times. Seventh, eighth and ninth washings, acid and gas.

May 1*st*.—Bottle washed out three times. Tenth and eleventh washings, acid and gas. Twelfth washing, unchanged. Control unchanged.

May 2*nd*.– Twelfth washing re-examined; acid and gas found. Thirteenth washing gave acid and gas.

May 8*th*.—Bottle washed out twice. Fourteenth and fifteenth washings, unchanged.

May 9*th*.—Fifteenth washing examined again, and found unchanged.

May 10*th*.—Fifteenth washing examined again and found unchanged.

May 12*th*.—Bottle put in incubator for four hours. Fifteenth washing examined again after incubation; result, acid and gas.

July 13*th*.—Fifteenth washing examined again; result, acid, no gas.

(*b*) *January* 14*th*.—A sterilised bottle was filled with impure water, which was left in contact for twenty-four hours.

January 15*th*.—Washed out three times in succession with sterile water.

Result :—Original water, acid and gas. First, second and third washings, acid and gas.

(*c*) *May* 4*th*.—A bottle was sterilised and filled with sterilised water which, when examined, was found to be unchanged. Bottle filled with impure water for two hours, then washed out twice with sterile water. Original water gave acid and gas. First and second washings, acid and gas.

May 8*th*.—Bottle washed out twice. Third and fourth washings gave acid and gas. Control unchanged.

July 17*th*.—Fourth washing again examined; acid and gas found. Bottle washed out again, and acid and gas found, while control remained unchanged.

July 25*th*.—Fifth washing examined, and acid and gas found.

(*d*) *July* 20*th*.—A sterilised bottle filled with sterile water. Examined; unchanged.

July 30*th*.—Put in incubator for twenty-four hours.

July 31*st*.—Examined; unchanged.

These experiments seem to show that water-bottles of wood or of enamelled iron of the present pattern, once infected, may remain polluted for some time, although frequently washed out with even sterile water, and that the sterile water put in also gets polluted.

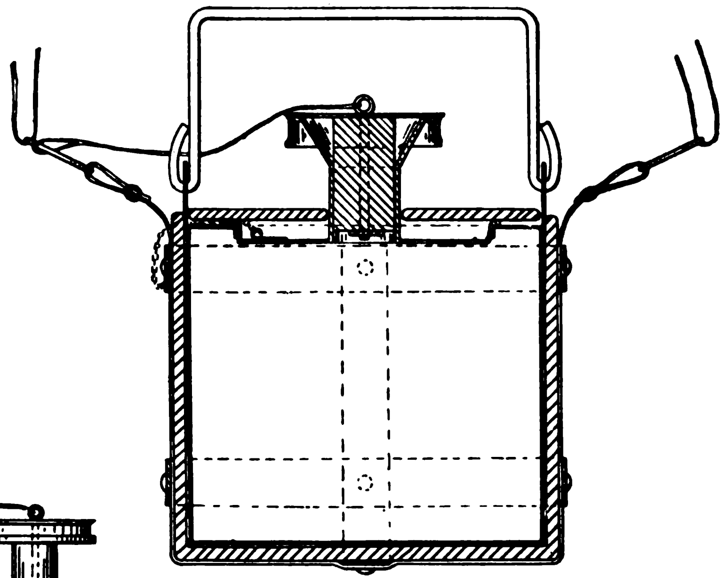

FIG. I

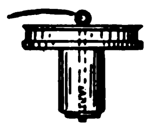

FIG. IV

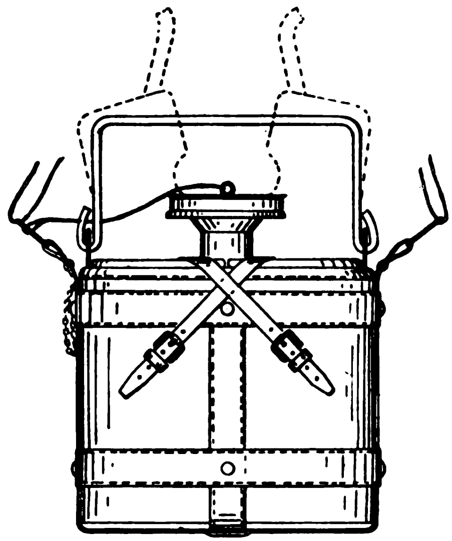

FIG. II

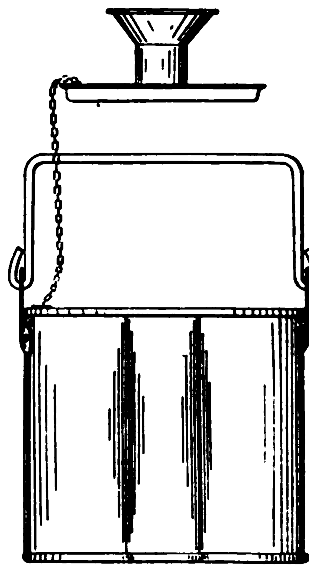

FIG. III

Fig. I.—Sectional elevation of water-bottle and sling.
Fig. II.—Elevation showing the bottle in the sling.
Fig. III.—Elevation of bottle alone.
Fig. IV.—Detail of cork.

It must also be noted that a bottle which had remained pure at laboratory temperature, became impure when incubated for four hours. The temperature of the incubator, viz., 97·4° F., is not an uncommon one in the tropics, and when it is remembered that the inside of a bottle is dark and dirty and cut off from the actinic rays of the sun, it is not surprising that organisms survive for long periods. Consideration of these facts seem to lead to the conclusion that a water-bottle, even of the latest pattern, is a perfect typhoid trap. Its defects appear to be: (1) It cannot be cleaned, with the result that it must become offensive, especially in hot climates. In talking this over with a brother of mine, who commanded a company of his regiment through most of the South African War, he said that men refused to drink out of their water-bottles on account of their offensiveness, but preferred to take their chance with water from the spruits. (2) A sterile bottle holding dirty water for two hours becomes polluted, and with no means of sterilising the bottles in use it would be useless to supply pure water without at the same time providing means of sterilising the bottles. (3) The funnel-shaped spout of the bottle of latest pattern catches dust very easily.

On account of these defects a bottle of a new pattern has been devised, and permission having been obtained from the Army Council, a provisional specification was sent in to the Patent Office in January, and the complete specification is now under consideration. The four main points about the new bottle are:—

(1) Instead of being of enamelled iron, it is made of block tin or aluminium; and, in addition to the spout, contains a press lid, which can be taken off, so that it can be thoroughly cleaned out by the hand. (2) The felt covering, instead of being fixed to the bottle, is fastened to the sling, so that the bottle can be taken out and sterilised by being put on the fire. (3) The top of the cork has a metal expansion which fits over the base of the spout and prevents the dust getting in. The cork is attached to the felt covering and not to the bottle, and therefore cannot be injured when the bottle is on the fire. (4) A handle is attached, by which it can be lifted off the fire.

A bottle of this description can be kept thoroughly clean, and water can be boiled in it if safe water is not available. It can be sterilised by heat or by chemical tablets; and in this connection it must be remembered that a clean bottle can be more easily sterilised than one containing putrescent slime. By its use detachments of men would be rendered independent of transport for the supply of pure water.

THE INDIAN AMBULANCE TONGA.

By Lieutenant-Colonel H. HATHAWAY.
Royal Army Medical Corps.

Every medical officer who has been in India will remember the Indian ambulance tonga drawn by two bullocks. It affords most comfortable accommodation for four men sitting up, and when the

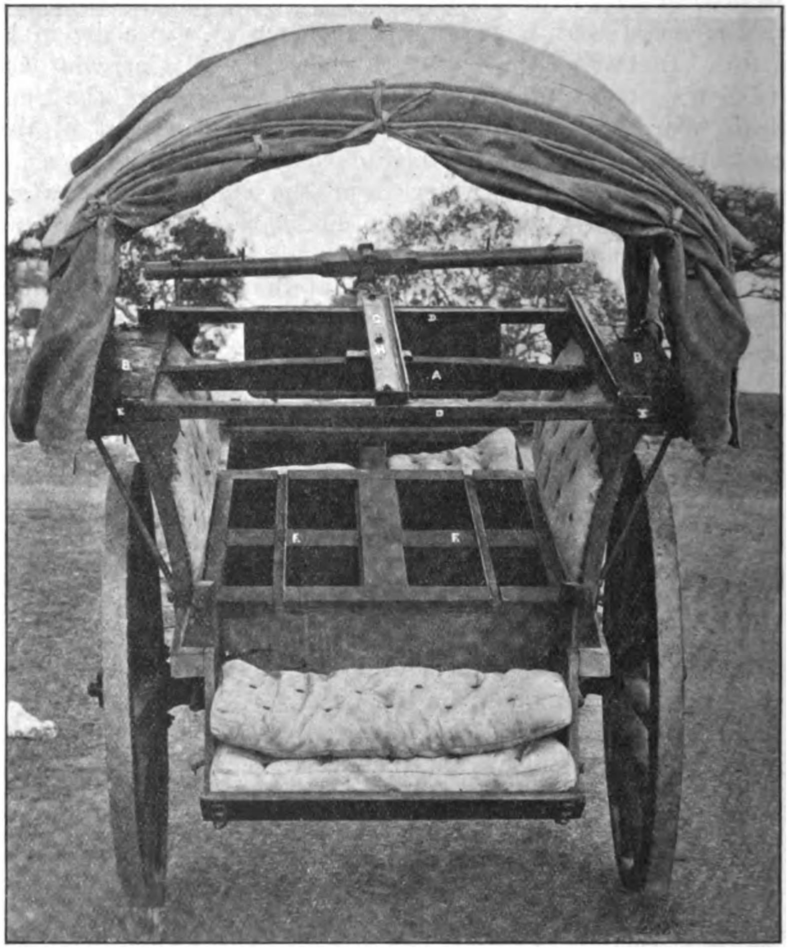

Fig. 1.—The tonga ready to carry three stretchers. The upper "H," formed by C, D, D, is turned on the bolt H to a right angle with the lower "H" formed by A, B, B the ends of D D rest on the sides of tonga B B and are bolted at E. There is a rail on the bar C and off-side of tonga B, so that a stretcher is run in on the off-side of tonga, then lifted to near side of frame; the second stretcher is run in on off-side and remains there. The third stretcher is run in below on the rails F F.

wooden frames are unfolded and the cushions spread on the top of them, one man (or two close together) can be carried lying down; but helpless patients who cannot step into the tonga are put in with difficulty; they are better on stretchers when out of bed. An

Fig. 2.

apparatus that I have invented, when fixed to the tonga, makes it possible to carry, comfortably, four men sitting up or three helpless patients lying down on regulation stretchers. The elasticity of the stretchers, the springs of the tonga, and slow action of the bullocks,

all make the carriage comfortable. This apparatus greatly increases the value of each tonga, and reduces the wheeled ambulance necessary on active service for the lines of communication, &c. And if it is becoming difficult to find suitable *Kahars* to carry dhoolies, it will be necessary to employ wheeled ambulance transport wherever it is possible in India.

The apparatus may be described as two "H" frames. When the "H's" are superimposed the cushions are arranged for four men to sit in the tonga. When the upper "H" is turned at right angles, for carrying stretchers.

For loading the tonga with stretchers, the first stretcher is run in on the rails on the off side of the framework, then lifted to the near side. The second stretcher is then run in on the off side and remains there. The third stretcher is then run in underneath. All stretchers are run in head first.

The hoods of the tonga are made of double canvas, and form good protection from sun and rain; they come down well beyond the handles of the stretchers, front and back, and there is ample ventilation for each man from the sides, for the curtains can be rolled up as required.

The new fixtures were applied to tonga at a cost of Rs. 25, but two folding seats costing each Rs. 20 and two rifle-racks costing each Rs. 6.12, total Rs. 53.8, are rendered unnecessary by the new fixtures, so that tongas could be made for Rs. 28.8 cheaper with my invention. The rifles would be carried on each side of the lower stretcher, resting in grooves made for them.

To prevent the stretchers shifting forward or backward in hilly country the stretcher slings are fixed at each end, loops passing over the handles and a turn being taken round the bar.

AUTO-INTOXICATION AND LIVER INADEQUACY.

By Major C. E. P. FOWLER.
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The subject of this paper is one which has caused great interest to pathologists and chemists, more especially in the last decade, during which time undoubted evidence of many cases of disease, produced by this cause, have been brought forward. The appreciation of this factor in disease even now is not fully given its true place in clinical medicine, and for this reason I venture to put forward some recent views on the subject. Looking back on past clinical experience it is evident that many cases of sickness, due to this cause, have been overlooked and called by one or other of the names which may cover such a multitude of the unknown, as malaria, simple continued fever, or even enteric. In the first place, how are we to define auto-intoxication? The name itself explains the meaning to a great extent, but briefly we may say that the term is used to embrace those cases of disease in which a patient is suffering from the effects of poisons or toxins manufactured in his own person. The wide subject of toxins derived from food containing the poison when ingested will not be discussed. Again, what do we mean by the name toxin? It must include substances which are known under the terms ptomaine, leucomaine, animal alkaloid, &c. The definition may be put down as "an alkaloid produced by the decomposition of some animal substance," or "an organic base derived from some animal source." Originally, the term was applied only to an alkaloid derived from cadaveric decomposition, but it now includes also alkaloids of animal origin formed during life, as the result of changes brought about by some agent acting within the body. The term leucomaine was introduced to distinguish the latter. It would seem best to class all these toxins together under the name of animal alkaloid, in order to differentiate them from the vegetable alkaloids. Many of these alkaloids, vegetable and animal, are quite harmless, others are of a highly poisonous nature, a few derived from animal sources possessing the most powerful poisons known to science; many of the vegetable derivatives are well established as therapeutical agents.

The animal body may be considered as a laboratory, in which are being manufactured all kinds of products, resulting either from the breaking up of food material in the processes of digestion, or

from the breaking down of the body cells in metabolic katabolism. Let us deal first of all with the normal healthy body and see briefly what these processes are which take place. To do so, it will be necessary to follow out the changes which certain of the foodstuffs undergo before they become absorbed as part of the body substance, and then to trace what happens to the cast-off or waste material from the body cells. Regarding these changes in foodstuffs, more especially the proteid, a vast amount of research has been carried out during the last two years, relating to the end-products resulting from the action of the intestinal and intracellular juices; and we now know that a very much more complicated series of reactions takes place than was formerly imagined. These investigations have been confined almost entirely to the chemical aspect, but a certain amount of enquiry has also taken place regarding the *rôle* of bacterial action. Finality has by no means been reached, and there still remains a vast problem for elucidation. Turning first to the chemical side of the question, we will trace the history of a proteid substance as dealt with and made use of by the body.

The proteid molecule is a heavy and complex one, which by a process of hydrolysis in digestion becomes split up into smaller and smaller molecules. Under the action of the four digestive proteolytic ferments, pepsin, trypsin, erepsin and arginase, the albuminous matter is converted into primary crystalline dissociation products, the amino-acids, &c. Most of these may be included under the following heads: (1) The base ammonia; (2) the mono-amino acids, such as glycin, alanin, leucin, asparagin, aspartic acid and glutamic acid; (3) the diamino-acids, such as arginin, lysin, ornithin and histidin; (4) the aromatic amino-acids, such as phenyl-alanin, tyrosin and tryptophane; (5) the mono-amino acids, containing sulphur, cystein and cystin; (6) the chromogenic group, such as indol and pyrol derivatives; (7) the purin bases, such as adenin, guanin, hypo-xanthin and xanthin. The pyrimidin bases, such as cytosin, thymin and uracil.

Such a formidable list as the above must bring home to one's mind the highly complex nature of the original proteid molecule, which is built up out of the nuclei of all these dissociation products, linked together in more or less intricate groups. It appears now to be the general opinion that all proteid matter ingested must undergo this complete hydrolysis before absorption from the intestinal tube can take place, but there are still some observers who maintain that a certain amount of the albuminous matter can be absorbed in the form of albumoses, peptones and peptids. Such changes in the

proteid molecule are analogous to those which we know happen to the starch molecule. This heavy molecule becomes split up by digestion into smaller and smaller molecules. First the dextrins are produced (analogous to albumoses and peptones); on these follow the molecules of maltose (analogous to the polypeptids), to result in the simple molecules of glucose (analogous to the amino-acids).

Now a word as regards the part played by bacteria in digestion. It seems scarcely likely that Nature would provide such varied types of bacteria in the intestine without some special purpose. We know that the intestinal contents of the new-born child are generally sterile, but within a very few hours, and after the first few feeds, many kinds of the bacteria found in after-life make their appearance. It is only common-sense to say that these bacteria must have some very definite share in the normal processes of the intestinal tract, but their exact sphere or duty has not yet been worked out.

Experimental evidence shows that such organisms as *B. coli*, streptococci, *Proteus vulgaris*, and some forms of the yeasts, have certain very definite reactions on albumen. At first their action simulates exactly that of a digestive ferment, such as trypsin. The albumin is broken down into albumose, peptones, and subsequently amino-acids. The amino-acids are further differentiated into their corresponding simple acids, such as acetic, propionic, butyric, caproic and valerianic acids, &c., or they are split up with the separation of carbon dioxide and the formation of certain diamines, such as cadaverin, putrescin and phenylethylamin. It would seem but reasonable to suppose that identical changes take place in the animal gut, but actual proof of such being the case cannot be definitely stated.

It is only necessary for us to glance over the list of end-products which may be produced in the intestine, to grasp the fact that herein lies the origin of grave danger to the organism should these products pass on to the general circulation in an unmodified condition, for many of them are well known to us to possess the power of active and poisonous animal alkaloids. Experimental evidence also proves this quite clearly. The blood coming direct from the intestine and containing the products of absorption is very toxic. On extirpation of the liver or on tying its vessels in animals, it was found that they quickly succumbed, with all the symptoms of an acute toxic poisoning. Again, when a fistula was made, diverting the blood from the portal vein direct into the vena cava, so cutting off its passage through the liver, the same train of

symptoms developed. Further, if the blood from the portal vein of one animal is passed into the circulation of another of the same species, toxic symptoms quickly ensue; while the blood from the vena cava injected in the same manner has little effect. We are, then, bound to admit that we are at all times making the best endeavours in our unconscious inner workings to bring about self-destruction. What agent stands in the way of such self-poisoning taking place, and what agent is it that modifies, changes or neutralises these poisonous products of normal digestion? We know without doubt that this important function lies with the largest organ of the body, the liver. Up to within quite recent times this organ was looked upon as an addendum of the digestive apparatus, and its chief function was considered to be that of secreting a fluid, the bile, to aid in the processes of digestion. This idea has been a difficult one to eradicate, partly because the liver was known to originate from the entoderm, and therefore was looked upon as a necessary adjunct and help to the digestive apparatus, and partly on account of its position in proximity to the other organs of digestion. At the present day it is necessary for us to dismiss from our minds all idea of the bile taking any active part in digestion; it is now well known that it has no such action, outside the passive ones of lubricant and dialyser. The main function of the liver is that of a filter or a neutralising agent, combined with certain modifying reactions on some of the food products.

A word now in reference to the products of katabolic metabolism of the living tissues, and the disposal of their waste material. Each cell, in its cycle of vital activity, casts off the waste products of its existence; these products are of a toxic character. Three normal fatigue substances are now recognised, namely, paralactic acid, mono-potassium phosphate, and carbon dioxide. A muscle, when irrigated with a weak solution of any of these substances in physiological salt, and compared with a companion muscle irrigated with physiological salt solution only, is already, in some degree, fatigued, and on stimulation shows an earlier and more pronounced development of each successive stage of fatigue up to complete exhaustion. Similar effects have also been proved by the experiments on living animals in reference to fatigue toxin. It has been clearly shown that when the blood from a fatigued animal is injected into the circulation of a normal animal of the same species the latter suffers from fatigue effects. These effete products of the metabolic activity of the body cells must be eliminated as quickly

as possible if the normal equilibrium of the system is to be maintained. This duty, again, is carried out to a very large extent by the liver, which eliminates this waste material as it passes through the hepatic circulation.

It can now be seen how extremely diverse and complicated are the duties which the liver is called upon to perform, if that organ is to save the body from the effects of toxins derived either from the end-products of digestion, or from those of cell waste. It is only necessary to remember its size, to understand the amount of work which it undertakes, and to be reminded that the quantity of bile excreted equals in amount the urine daily passed by the kidneys. If the statement is correct, that the liver acts as a filter or neutraliser of toxic material, we should expect to find that its excretion contained some poisonous properties. Such is undoubtedly the case. The bile, when injected hypodermically or intravenously into animals, is powerfully toxic; and yet, when poured into the intestine in the normal process of excretion, it has no harmful effect. This can be explained by the fact that the bile salts are precipitated in the intestine, and its deleterious constituents are not then capable of absorption. We can, therefore, state that the chief functions of the liver are the following: (1) To act as a filter and eliminator of the harmful end-products of normal digestion and cell metabolism; (2) to act as a toxin reducer; (3) to elaborate certain of the end-products of digestion, changing their constitution, so that they may be in a suitable condition to be eliminated by other organs of the body; (4) to elaborate certain of the end-products of digestion, and store them up for future energy.

The first duty named above has been enlarged upon. The second, also, has to some extent been dealt with, but there remains for elucidation under this head the power to deal with toxins produced by pathogenic organisms. The third duty embraces the changes brought about by the liver cells in the elaboration of such substances as urea and uric acid from the ultimate products of digestion. The fourth duty refers to the elaboration of the complex molecule glycogen, or animal starch, from the simple starch molecule.

Having now considered this question from its normal physiological side, it remains to discuss its bearing in some of the phases of disease. We have seen that in the animal body processes are going on which have the power, should their normal balance be upset, of entailing disaster on the individual. Let us discuss first of all a very simple case, where a patient makes the only too common error of exceeding his proper food supply. What happens

in many cases? Symptoms are produced which we know by the name of dyspepsia, a term which includes a multitude of ills. What has really taken place? The food remains in a semi-digested condition in the gut, and is the prey of bacterial action, with the production of toxic material. This passes to the liver, which is called upon to cope with the neutralisation of these toxins. It may have the power to do so, but if not the well-known symptoms are produced of headache, lassitude, and general uneasiness. Again, we will take it that the powers of digestion are able to grapple with the excess of food. The end-products are carried to the liver for elaboration or elimination. It may have the power to carry this through, but if not, we get the well-known symptoms of plethora, from the passing on of certain of the end-products unchanged; followed in aggravated cases by symptoms which we call "torpid liver," "biliousness," or by some other vague term. Again, let us imagine that the liver, for some reason, either from chronic irritation by toxic material from the gut or from some poisonous infective agent, loses the power of coping with the materials circulating through its substance. What follows? Let us instance such conditions as gout and uræmia. When considering these two diseases it is natural to think at once of the kidneys being primarily at fault; but is this really so? Recent work would point very markedly to the liver as being the primary factor in the disease. We know that urea and uric acid, when ingested by, or injected into, animals are quite harmless; and yet the precursors of these substances, such as ammonium carbamate or carbamic acid in the case of urea, the nucleins and xanthin bases in the case of uric acid, are extremely toxic. It is the duty of the liver to convert these end-products, ammonium carbamate, xanthin, hypoxanthin, adenin, guanin, &c., into harmless substances, such as urea and uric acid, which are forthwith eliminated by the kidneys. Should the liver fail, a certain amount of these materials passes through to the general circulation, but is not in a suitable condition to be eliminated by the kidneys, and therefore is left to accumulate and poison the body. The kidneys in all probability really suffer from secondary irritation. Uræmia should, then, be looked upon as anuræmia, and the patient as suffering from non-formation of urea, and therefore poisoned by the unchanged end-products of his food and body metabolism. Such is the case, too, in puerperal eclampsia. The liver, during pregnancy, is called on for a great increase in the elimination of effete material, and should the woman herself be careless in diet, the balance may just be upset, the liver overtaxed in its power, toxic material passed on, and the well-known

symptoms supervene. The kidneys have not been primarily to blame, the liver has been called on for too great a task and has failed.

At a recent meeting of the Medical Society of London (December, 1906), Sir Lauder Brunton opened a discussion on "Hepatic Inadequacy in Relation to Gout," and brought forward experiments showing that the liver possessed the power of converting uric acid or urates into urea. Dr. Luff stated that he wished to raise his voice against the present fetishism of uric acid, as he was unable to recognise that uric acid could in any sense be considered a poison. He regarded uric acid as a comparatively harmless by-product of the human economy, which in many quarters had been most dangerously exploited as a poison. The liver was an important organ in regard to gout, but though it was capable of converting uric acid into urea, that amount of conversion had no part or parcel in the pathology of gout. Gout was an auto-intoxication, but he believed that might be due to the bacteria present in the intestinal tract, which, under certain conditions, became altered and caused the toxin of gout. The liver could destroy that toxin, but if the functions of the liver fell below par, then the toxin would cause gout. What amount of truth there may be in this theory of Luff's is for the future to prove, but that both gout and uræmia are conditions caused primarily by inadequacy of liver action in failing to deal with the toxic end-products from the gut, and changing them to harmless substances, appears now to be beyond all doubt.

There are many observers who are of the firm opinion that overloading of the gut with foodstuffs, more especially of the proteid type, plays a large part in preparing the body for the attacks of the organisms of disease. This may be brought about to some extent by the local condition of the gut, which becomes the breeding-ground of putrefactive bacteria; but also, and to a still greater extent, by the constant overloading of the liver with effete material, which it is powerless to neutralise; consequently the system becomes saturated and a ready prey to disease. A typical instance of this condition may be cited in so-called "simple continued fever" of the soldier, a term looked upon formerly as a cloak for the diagnosis of the ignorant; but it is undoubtedly a well-marked condition, and not always due to the invasion of the *Bacillus typhosus*, or *B. paratyphosus*, as would be claimed by some. The condition meant is that of a patient suffering from continued or irregular fever for seven or eight days, with foul tongue, headache and general malaise. We suspect enteric at once in the Tropics, but the fever falls and

everything clears up. What are these cases? In vulgar language they can be described as "putrid gut." Toxic material has been absorbed in large amount from the bowel, into which unsuitable or overmuch food has been introduced; and the liver has been overtaxed, allowing the toxic substances to pass on; the patient suffers from auto-intoxication, until either Nature or medicine rids him of his incubus.

Now let us glance at the effects of microbial invasion, and we will take first the case of the common cold. As a relic of custom we are inclined to attribute the common cold to draught or chill, whereas we know in our own minds that the invasion of bacteria is the true cause in nearly all cases. Why should we feel seedy with a cold? It appears a simple affair enough. Look at it from a common-sense aspect, and we see that the invading bacteria are manufacturing some waste material or toxin which overtaxes the powers of the body filter and we are being poisoned by their products. The same series of symptoms are produced by the specific infective organisms, each having its special train of effects, but in nearly all cases the results are similar. It would be too bold a statement to make, that as long as the liver can perform its functions no toxin can have effect; but the fact remains that in nearly all cases where toxic poisoning takes place and ends in death, the last train of symptoms is of very similar type, such as drowsiness, coma, Cheyne-Stokes breathing, and convulsions, the classical signs of poisoning from the retention in the system of metabolic products.

The sources of toxins, as developed by the animal organism, have been briefly dealt with, and an endeavour has been made to indicate that on liver efficiency lies, to a very great extent, our immunity to injury by these dangerous products. That intoxication by these self-made agents takes place there can be no doubt, if we consider the subject in a rational manner. Our petty ills are to a large extent due to this flooding of the liver with effete material: the graver effects are masked by the initial disease process. Cases of acute auto-intoxication are not common, but once seen are nct quickly forgotten. Such a case was seen by the writer some two years ago, in which the patient, a man of robust constitution and perfect health, was attacked and succumbed in forty-eight hours. An impression such as this brings home to one the ignorance there is in certain branches of study. The subject was a strange one to me at that time, and thinking that others may be in like ignorance, this somewhat discursive article has been brought forward, in the hope that reference may be made to, and knowledge gained by reading, some of the literature mentioned below.

As regards clinical work, can we glean any hints with respect to treatment if we accept these views on auto-intoxication as reasonable? Most certainly we can do so. The indications would enhance still further the importance of the maxim of treatment in the Tropics, viz., to keep the gut in as clean a state as possible. This maxim should not only be applicable in disease, but also in health. We are mostly agreed that the European soldier in the Tropics does not conform to an ideal standard as regards his diet. This, to a great extent, is controlled by his habit of living, but there can be no question that the sooner our soldier, and officer too, can break away from the idea that a large consumption of food, more especially of the proteid variety, is necessary to his existence, the sooner will be brought about a diminution of disease, certainly of its intestinal forms.

In our treatment of disease the indications point to either clearing the gut of offensive matter by calomel or some other smart purgative, thereby cutting off the supply of noxious and effete matters, or to neutralising further fermentation and putrefaction by the aid of non-poisonous disinfectants.

Some observers scoff at all idea of rendering the gut contents less offensive by the administration of disinfectants, but the proof lies with results, and very many clinicians have claimed great benefit from the treatment. To what extent the more powerful disinfectants now available will effect this desirable object is a matter of conjecture and trial. That enteric patients do suffer very markedly from auto-intoxication there can be no question, and if the contents of the gut can in any way be relieved of the putrefactive conditions, a very marked change for the better in the symptoms supervenes.

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SANITARY NOTES.

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Introduction.—Under the provisional scheme of Sanitary Organisation, outlined in War Office Memorandum 4840/1146 (A.M.D. 1) dated March 29th, 1906, on the "Prevention of Disease in War," eight men from each battalion at every brigade camp last summer, in the Aldershot Army Corps Command, were detailed to be trained in sanitary duties by the medical officers in charge of brigades. These notes represent the work done by the sanitary class of the 2nd Infantry Brigade at Bourley Camp, which lasted six days. At the end of these notes, it will be seen that the new field service filter cart plays an important part, for the care and working of which certain specially trained men of the Corps are exclusively detailed. These men are now trained at the new School of Army Hygiene at Aldershot, under the direction of Lieutenant-Colonel R. H. Firth, R.A.M.C. A good description of this water cart with photographs can be found in "Notes on Military Sanitation," by Lieutenant-Colonel H. P. G. Elkington, R.A.M.C., published by the St. John's Ambulance Association, London (price 1s.), and also in a short article in the Corps Journal for April, 1906, by Major T. McCulloch, R.A.M.C.

Report of the Work carried out by the Sanitary Class at Bourley Camp of 2nd Infantry Brigade, July, 1906.

(Fig. 1.) A refuse destructor was built, after the pattern (slightly modified) suggested in Lieutenant-Colonel Elkington's "Notes on Military Sanitation." Every kind of rubbish, except liquid slops (which were deposited in tubs for the contractor) were collected and sorted. All tins and bottles were buried and the remainder burnt in the destructor. The heat generated was so intense, as to melt bottles accidentally dropped in. On arriving in camp, which had been previously occupied by mounted infantry, owing to the several horse lines, long grass and small bushes, in a wood in the centre of the camp, it was thought probable that flies would become very prevalent. But the actual result was, that there were less and less flies each day owing to this daily and constant system of conservancy. When the camp broke up, only half an hour's work was necessary to leave the camping ground cleaner than it was when the brigade marched in.

This destructor was stoked from the top and the ashes raked out from the flues underneath and buried with the tins and bottles. In order to secure the best results, one small addition appears to be necessary to this form of destructor. A hoop of iron (fig. 2) to rest on the corners of the four trenches inside, at the base of the chimney; with a couple or three pieces placed either radically or sectionally to the circle of the hoop. This, by keeping the burning material from the floor of the chimney, keeps the flues free and

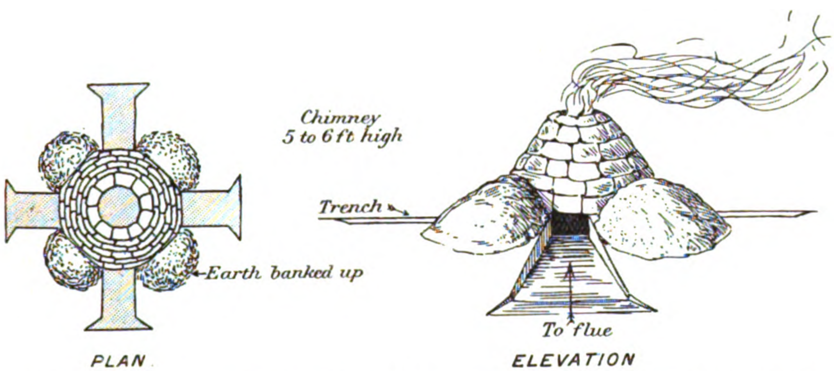


FIG. 1.—*Measurements:* Trenches, 6 feet long, 1 foot 6 inches deep, 12 to 15 inches wide, with splay mouths; bore of chimney, 12 to 15 inches *square;* four flues.

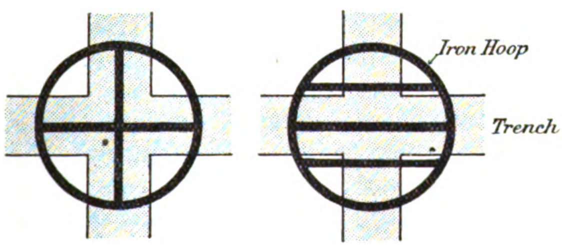


FIG. 2.

ensures draught, and further, acts as a necessary support to the first placed sods crossing the trench at the base of the chimney, without which, having to bear all the weight, they give way. When finished the draught is improved if the chimney be plastered with mud, inside and out.

These iron hoops could easily be knocked together by one of the pioneers, who is a smith. Of course it must be noted that where

turf or sods are not available and the ground is very sandy, this type of destructor is not so suitable.

Latrines.—As the dry-earth system with pails was used and the contractor was responsible, there was no scope for practical instruction, but "Instructional Latrines" were made, and when the brigade went to Frensham for divisional training they were used, and appeared very successful. The following plan was adopted, and for the old pattern long trench was substituted a row of small parallel trenches 2 feet 6 inches by 1 foot and 2 feet apart, depth 1 foot 6 inches. The points of improvement noted were:—(1) Position of squatting astride more comfortable than on the edge of a trench; (2) practically no fouling of the ground either by fæces or urine; (3) less digging; (4) easier to get dry earth used more effectively (of which men can scrape a little in with their foot, or a piece of wood). Each set of holes lasted about three days and were about 5 per cent. to 7 per cent. of the strength in number.

Urine.—At night empty pails were placed at the centre of each line of tents; with the exception of one regiment, who were not in favour of this method and were purposely allowed to use the urine tubs (as they said) in the latrines, a short distance away. The next morning each of the other regiments had filled ten to twelve pails, and this regiment only filled about three and a half pails. As they were by far the strongest unit in camp, they were unable to explain this extraordinary deficiency. After this was noted they adopted the same method as the other regiments. At Frensham no provision was made for night urine in the lines, and the latrines were in some instances nearly half a mile away. The deduction appears obvious.

Messing Systems with regard to Sanitation.—One regiment was messed all together on the regimental system, by a contractor, in a large marquee. This was most excellent from a sanitary point of view, there being no food in the lines or any of the tents. However, at Frensham, where they could not carry out this system, and there was no contractor to look after them, their messing was the worst in the brigade, and the waste considerably greater than any other unit.

Grease Pits.—These were dug and filled with furze and a layer of stones at the bottom. They were used for greasy washings from camp kettles, mess tins, &c. Every other day or so, the furze was taken out, burnt in the destructor, and fresh furze put in. This plan appeared to work admirably and saved fouling of the ground, besides supplying easily inflammable fuel for the destructor.

Washing Places.—The ablutionary arrangements at Bourley on arrival were somewhat unsatisfactory: a series of raised metal troughs in the wood, with no surface drainage, and the stand pipes some little distance away from each. This small wood was low-lying, in the centre of the camp and somewhat badly placed as regards surface drainage. At previous camps a large portion of it became a swamp. With a view to improving matters, the sanitary party dug suitable serviceable surface drains for each regimental washing place, leading into a series of pits, which were filled in with earth when done with. The result was that the ground was kept perfectly dry and wholesome. Sanitary sentries were posted at the principal washing times, to see that the men emptied the buckets down the troughs, and not on the adjacent ground.

Method of Training Adopted.—Nothing was attempted in the way of lectures. Practical instruction only was given, the reasons for everything being explained as the work was proceeding, simply, and often repeated, and only the most obvious and elementary things touched on. The class "fell in" at certain hours, at least three times a day, and did about two hours hard work each time. Each unit was kept to the work of its own regimental area, except in the case of the destructor and sorting ground, which represented a sort of miniature County Council works for the whole brigade. A roster was kept for this duty. A spirit of emulation was promoted amongst the units, and all worked hard and appeared to take a certain amount of interest, with the exception of a few "slackers," who thought it was going to be a "soft thing" to be struck off all duties and sit and listen to lectures. But they were rather disappointed when they discovered they were doing as much, if not more, physical work than if they had been at regimental duty and out on field operations. The whole of this class was struck off all other duties and the medical officer never left camp, so as to give constant and unremitting supervision.

Conclusions.—The question that must be settled definitely is: who are these men to be? One regiment furnished its pioneers, the others took men from the ranks. There is no question as to which men are the best for this work. The pioneers do the work far better and need but little instruction. They are always pioneers, they are used to this sort of work and have always done it, and by using them men are not taken from the ranks. In some brigade camps it appears that the sanitary class had a daily lecture only, and did all the other regimental duties, going on field days, &c., and the pioneers, under their quartermasters, just carried on as

usual, on their own lines, without any organised system. In this way this scheme would be a failure. The opinion of a number of units was taken, and the majority were of opinion that of the eight sanitary men, if not all, at any rate half of them should be pioneers. There are usually ten pioneers to a regiment. It was urged by some that pioneers are tradesmen, that although they have in the past done this work, yet it is not their proper work, and now that trades are to be taught in the Army, it would still less become their function; further, it might be thought derogatory to them.

Against this is the fact that in peace time, especially at home, there is practically no sanitary work to be done; it is only when in camp or in the field. Further, that on active service, for which the whole scheme is framed, these tradesmen have no shops or trades to carry on, except in a few limited instances. And prevention of disease should and must be placed on such a footing as not to become, or even be thought to be, derogatory to those carrying out the detail.

With regard to water supply, nothing could be done at Bourley, from a practical point of view, and it is regretted that a filter water cart of the new pattern was not available for instructional purposes.

A Memorandum was drawn up (appended) with a view to explaining the rough idea of the scheme to officers and others. This was based on the War Office letter on prevention of disease; and the leaflet on personal hygiene was issued for the information of the men.

Summary.—Without presuming to criticise, it may be said, as a result of our short experience, that there is no doubt that the scheme, as a whole, appears practical, practicable and successful, if worked on the right lines; and it should be highly valuable as an organisation for the prevention of disease. But it must not be forgotten that it nearly all depends on the initiative, unremitting interest, practical knowledge and experience of the medical officers concerned, and who themselves—in many cases, however great their theoretical knowledge may be, chiefly among the junior ranks—require practical instruction and experience, which can only be obtained in camp and in the field. It is suggested, therefore, that the junior medical officers be attached in each camp to a Royal Army Medical Corps officer having greater practical experience for instructional purposes; and also one or more non-commissioned officers and men of the Royal Army Medical Corps, who have been through the Hygiene School at Aldershot. Further, that the question of pioneers be definitely settled. That all the

smaller units, such as batteries of artillery or companies of Army Service Corps, &c., be in some way brought within the scope of this scheme. And finally, it is most important that regimental officers should be educated in, and brought to take an active and responsible interest in, this work, as without their whole-hearted co-operation this scheme will be most seriously handicapped and may prove a failure.

MEMORANDUM.

Hygiene (or Prevention of Disease) in War.

In order to attain any measure of success this, like all other military problems, must be carefully studied, practised and prepared for in time of peace.

It will simplify matters to take the question as a whole, under two distinct headings. Hygiene—(1) General; (2) Personal.

(1) General.

It is acknowledged that enteric fever and dysentery are the two principal diseases, and which cause the greatest wastage in the field.

Three Factors are: (*a*) Contact with the affected; (*b*) imperfect disposal of excreta; (*c*) impure food and water.

Proposed Sanitary Organisation.

G.O.C. in C.—P.M.O., Staff, and Sanitary Officer.

Unit Sanitation:
- 1 Medical Officer
- 1 N.C.O. and 8 men of unit dealing with
  Refuse disposal. Excreta.
  Sanitary Police, &c.
- 1 N.C.O. and 4 specially trained R.A.M.C. men
  deal with Water Supply (new filter cart),
  Disinfection, and the Sick.

Lines of Communication and Base:
Sanitary
Branch of R.A.M.C.

(2) Personal.

A few of the simplest and most obvious points are drawn up on the attached sheet, and it is suggested that company officers, on whose sympathy and active co-operation chiefly depend the success of these measures, should distribute copies to responsible N.C.O.'s with a view to

gradually educating the men. It is not suggested that these measures are, or have been in the past, neglected; but it is thought their full importance has not been realised. The recent wonderful success of the Japanese Army, who paid as much, if not more, attention to these details seemingly than to general hygiene, has emphasised this. It should be further noted that no money, equipment, organisation, or *personnel* are required, only patient co-operative education.

First aid and ambulance work are best left to the R.A.M.C. and those told off for that work, but every soldier should know the value and use of the first field dressing.

(*Signed*) F. HARVEY, *Captain, R.A.M.C.*,
M.O. in Charge 2nd Infantry Brigade.

Blackdown,
July 6th, 1906.

[Extracted from W.O. Memo. 29.3.06, P.M.O. A.A.C.2287/2.]

Leaflet.

BRIGADE TRAINING, 2ND INFANTRY BRIGADE.

HYGIENE (OR PREVENTION OF DISEASE) IN WAR.

Personal Hygiene must become a part of the soldier's daily life, and it should be a point of honour to take all possible means thereby to prevent sickness of any kind.

(1) *Care of Body.*—Trivial complaints such as boils, whitlow, toothache, &c. reduce the fighting power of an army. Therefore great care must be taken to thoroughly wash all parts of the body daily.

Note (a wet towel for the armpits and fork is better than nothing when water is scarce).

Hair.—Always to be kept short.

Teeth.—To be thoroughly cleansed night and morning with tooth brush, soaped, and then dipped in carbolic or other tooth powder. This to a very great extent prevents decay of the teeth and toothache.

Hands.—Dirt causes whitlows, and germs enter the blood through cuts, &c.; also food gets contaminated by handling it. Therefore, keep the hands as clean as possible and the nails short, as germs collect under them.

Feet.—Sweat condenses, decomposes and causes inflammation and blisters; always wash the feet carefully after a march and put on clean socks if possible.

Note.—Changing the socks from one foot to another, and turning them inside out, is better than nothing as a temporary expedient.

In the case of mounted men the fork and buttocks should be carefully washed and powdered with boracic powder, if showing any signs of redness or soreness.

(2) *Food and Drink.*—Avoid excess of any kind. Chew food well, eat slowly; rest after fatigue before eating. Avoid uncooked food and

never drink unauthorised water! Tea, coffee and tobacco are good. Alcohol, if taken, should be used with the greatest moderation.

(3) *Marching*.—Water bottles to be kept clean inside, and filled. Self-restraint on the march is a great point. At a halt, the mouth should only be rinsed out. Sunstroke is induced by fatigue, want of sleep, thirst, abuse of alcohol, excessive sexual indulgence and tight garments. Therefore lead a temperate life, have a midday halt, wear clothes loose and easy, keep the bowels regular, and the head well protected.

(4) *Infectious Diseases*.—The principal are enteric fever and dysentery, which are caused by swallowing small germs. More men are killed and invalided by them than by the enemy.

Therefore pay the greatest attention to paragraph 2. Not only does a man become a danger to himself, but he may imperil the whole field army, and it should be a point of honour to conform to the general sanitary orders that are issued in camp and on the line of march, and also to the above personal measures.

Aldershot,
July, 1906.

(*Signed*) F. Harvey,
Captain, R.A.M.C.
M.O. in Charge 2nd Infantry Brigade.

ENTERIC FEVER: A WATER-BORNE DISEASE.

By Major NORMAN FAICHNIE.
Royal Army Medical Corps.

Under this heading I hope I may be allowed to reply to an article by Surgeon-General R. H. Quill, A.M.S., entitled "Enteric Fever: Is it invariably a Water-borne Disease?" which appeared in this Journal in September, 1906; more particularly do I wish to reply because the epidemic at Diyatalawa, the camp of the Boer prisoners, has often been cited in the lay and medical press as an undoubted instance of a fly-borne epidemic of typhoid fever.

In my paper published in this Journal in May, 1906, I endeavoured to show that flies, dust and contagion have little to do in causing epidemics of enteric fever, and therefore I could not pass over in silence the outbreak at Diyatalawa reported in the Army Medical Department Report of 1900.

Briefly, amongst 5,028 Boer prisoners, 600 cases of enteric fever occurred; the epidemic began fourteen days after the arrival of the fourth transport from South Africa, after the onset of the rains, and subsided when they stopped. No attempt was made to purify the water supplied to the Boer camp, as it was considered above suspicion. Having once spent a holiday in this part of Ceylon, which, though partly covered by jungle, is also the heart of the tea country, I made the statement that from the report as it stands it appears not impossible that the source of the water supply had been contaminated by an unsuspected tea estate, either by manure on the soil, or by the excreta of the numerous coolies working on it. To the suggestion that the water supply could have been polluted as above, Surgeon-General Quill gave an emphatic denial, but on account of information recently received from Ceylon, I propose to answer his reasons for considering the water pure above the intake.

Surgeon-General Quill states: "(1) The source of the water supply was what appeared to be a spring on the mountain side, some three and a half miles from the camp. This intake was extremely isolated and most difficult of access, as was brought home to me when, in company with Sir Allan Perry, I climbed the mountain side in the course of our search for a pure water supply. I can safely state that the source we selected was entirely removed from danger of pollution by wayfarers of any description;

and as to the tea estates alluded to by Major Faichnie in his paper, the nearest was several miles distant. Between those estates and our spring was a dense jungle. So far as my recollection serves me I have fairly described the location of our water source."

As nothing definite is said about the water between the intake and its source, which is the chief point of my criticism, this is hardly a sufficient answer, because I quoted Dr. Thresh's rule, viz.: "to inspect a stream for pollution, every tributary, drain and ditch should be noted carefully, as well as the extent and character of the area liable to flood, and the proximity of highly-manured land." Information as regards the source, received from the Royal Army Medical Corps officer now in charge of the camp at Diyatalawa, is as follows: "About the water supply of the camp: it is derived from three separate sources, springing from the high ground above the railway. Taking them in order going from the camp, the first originates in a small patch of jungle. . . . . The second source is about half a mile further on: a stream about eighty yards long flows from a hollow in the hills into a concrete basin, thence through an iron pipe into the main, about 200 yards from and above the railway; the catchment area here is also uninhabited, but in the hill above the stream is a small portion of a tea plantation—there is no tea round the hollow, the source of the supply. The third source is about half a mile beyond the second; it is about a quarter of a mile away from the railway, but part of the catchment area here is a tea estate; a bungalow is on the hill above, and the water might be contaminated from this source; however, this source is not now used." From an entirely different source I have the same information, and also I am told that tea gardens slope up on each side of this third stream, and that these gardens are always manured; so that at the onset of the rains pollution from these tea estates, even though they are separated from the intake by dense jungle, would be conveyed into the camp in two hours' time.

Surgeon-General Quill states: "(2) The water in the large iron storage tanks located in the prisoners' camp was subjected to a weekly chemical examination, as well as to frequent bacteriological and microscopical examinations. The result invariably declared the water to be of great purity."

It may be noted that in the original Army Medical Department Report this is expressed differently: "Frequent chemical analysis invariably declared the water to be remarkably pure; a similar

verdict followed a bacteriological examination of the water." It is not quite clear, therefore, whether one bacteriological examination, or more, was made; this is important, as during the rains the quality of the water would alter with every shower; also, if the examination were made before the onset of the rains it would be valueless. A negative chemical examination is often, of course, of no value, as is well known and as may be demonstrated any day by simple experiment in a laboratory. Besides this, nothing is said of the nature of the analysis, and McConkey's test was not in use in 1900. Finally, if impurity is known to enter a water, it is quite immaterial whether it is found or not in the few ounces taken for examination out of several thousand gallons.

Surgeon-General Quill states: "(3) No alteration of any kind was made in the water supply or filtering arrangements during the time the camp was in occupation (over two years), yet no case of enteric fever occurred among the troops, or, I believe, among the prisoners, subsequent to the cessation of the imported (?) epidemic in December, 1900. I commend this fact to Major Faichnie, and would further remind him that the periodical rains continued in their due season, and that the tea estates remained under cultivation."

To this, in addition to the statement as above, that the suspicious intake was not now being used, the following information from the Inspector of the Public Works Department at Diyatalawa may be added. "Water from source at Hapartall was used when the camp was first opened. Latterly it was cut off, owing to supposed contamination by cattle, manuring of the estates bordering on its source, &c." In reply to as to when this was done, a minute is added: "It was about a year before the evacuation of the camp by the Boer prisoners."

The above information, obtained from three independent sources, as regards the water supply, does not tally with that given by Surgeon-General Quill. If his account of the water supply is right, then the epidemic at Diyatalawa serves as an instance, quite unique in my experience and reading, of a fly-borne epidemic where water could be absolutely and undoubtedly excluded; but if my version be correct, it gives yet one more instance of what I contend is so usual in any climate or any country, viz., given an impure water supply it is extremely difficult to stop enteric fever, as is shown by the fact that it occurred among the men forming the guard of the Boer prisoners, in spite of the minute precautions taken by

Surgeon-General Quill. Here it will be noted that, on the strength of the precautions taken, the disease is attributed to flies and contagion, but can there be any reasonable doubt that if the water were bad it was undoubtedly the original cause, however difficult it may be to say what was the exact method of infection? On the other hand, given a pure supply of water in pipes, so that it cannot be contaminated, however great the soil pollution, then even amongst Boers, with their notoriously insanitary habits, massed together in a moist tropical climate on the same ground for a long period, ground which had been without doubt specifically polluted by the severe epidemic, and with the camp no doubt swarming as before with flies, it is seen that enteric fever in epidemic form ceased and did not recur. To account for this, we find in the Army Medical Department Report that the diminution of the disease is put down to the redoubled efforts of those superintending the camp, and to the education in sanitation of those in it; but can there be any question that the great primary factor was the cutting off of the supply of impure water?

Until my information is shown to be wrong, I see no reason to alter my original statement that water cannot be excluded as the cause of the epidemic at Diyatalawa.

Editorial.

We have read with much interest in the last number of the Journal Colonel Forman's letter entitled "The Future of the Journal." It brings back to the mind far away schooldays and *Quot homines, tot sententiæ.*

Colonel Forman begins by saying that a considerable number of our officers do not subscribe to the Journal, which fact would seem to prove that there is a lack of general interest and that it is not widely popular. We must confess that the number of non-subscribers, 120, is larger than we would like. This is, as he says, much to be regretted, but we think it will be granted that in any body of men there will always be found a certain percentage who will be governed by private considerations rather than the general good. To some also the *res angusta domi* may be a not altogether unimportant argument. It will therefore probably be impossible under any circumstances to extend its popularity so as to secure the support of all. Next it appears to Colonel Forman that "the tone of the magazine has been too ultra-scientific, too strictly professional, and especially too prominently bacteriological." In January, 1904, we wrote that the main function of this Journal was to assist in the development of the Army Medical Service into a scientific corps by which a large part of the scientific medical work of the Empire would be done.

Colonel Forman places two kinds of papers side by side, "The Investigation of Malta Fever" and "The Humour of Indian Sanitation," and asks us "to look here upon this picture and on this." Let us do so. We see in the papers on Malta fever scientific work which has resulted in the discovery of the mode of infection of this dreadful malady, which has already lessened by some 90 per cent. the incidence of this fever among our soldiers and sailors, and which in all probability will blot out the yearly 70,000 or 80,000 days of illness from this cause alone which have disgraced the annals of the Army and the Navy in the past. This is work which will be honoured in all parts of the world, and will probably be quoted for generations as one of the most brilliant examples of preventive work in the history of medicine.

Is to search out the causes and prevent the incidence of disease in our Army not our real work? What is treatment in comparison

to this? What are clinical cases, descriptions of routine surgical operations, travel or sport, in comparison to such a result?

On the other hand we have "The Humour of Indian Sanitation," well written and full of humour no doubt, but disclosing a cynical and deplorable condition of things wherein stupidity and fraud seem to reign equally. Reforms may be brought about by ridicule, but, in our opinion, it is a roundabout way of doing the work, as scientific investigation must precede the reforms if they are going to be lasting and useful. It is also suggested by Colonel Forman that the papers on Malta fever need not have been published in full but merely presented in abstract. We, on the other hand, thought it would be useful to show in detail how work of this kind is done, so that it might serve as a model to our officers undertaking an investigation in out-of-the-way places.

Colonel Forman further believes that controversial matter should be admitted to the Journal. So do we, and we will publish anything of the sort, in reason, which comes in, and we also see no reason why correspondents should not use pseudonyms if they so desire—in fact, they have already been used. We do not agree with him in thinking that the Journal should take up the cudgels against anonymous writers in the public Press.

In conclusion, we would say in our defence that the Journal is what our officers make it. Every paper sent in is published if room can be found for it. We are not keeping back any papers from our brethren in the Reserve Forces who wish to discuss questions in which they are interested. Preference is certainly given to original scientific work, but this takes up comparatively little space, and when the Mediterranean Fever Commission comes to an end it will take up still less. We would wish to publish every paper immediately it comes in, but this is impossible, as only about 100 pages are allowed to each number. It is often proposed that the Journal should be printed on thinner, lighter paper, in order that officers might carry their copies about with them. This, we believe, is seldom done. If a set is bound and kept in each military hospital and mess there will be no necessity to carry it about. This could easily be done if officers would only present their copies to the hospital or mess instead of destroying them.

Clinical and other Notes.

NOTE ON *BILHARZIA HÆMATOBIA.*

By Major E. C. FREEMAN.
Royal Army Medical Corps.

No. 5829 Private J. G., 8th Hussars, was transferred to Colchester from Aldershot, suffering from *Bilharzia hæmatobia.*

The patient states that he contracted the disease while in South Africa when the regiment was encamped at Pretoria, the men bathing in a spruit known as Skinner's Spruit, near the Remount Depôt.

Forty-three cases of the disease are stated by Dr. Stock[1] to have occurred in the regiment, and a comrade of Private J. G. was admitted to hospital here with him suffering also from bilharziosis, which he traced to the same cause.

Both patients gave a history of being little affected at first, and of increasing pain and hæmaturia lately, especially when riding. A sample of Private J. G.'s urine was allowed to stand in the hygiene laboratory for a few hours and examined without centrifugalising. Ova were numerous, and two hatched out under the microscope in the undiluted urine, the first appearing active and strong and rapidly swimming out of the microscope field; the second, hatched some hours later, seeming to die immediately after getting clear of the egg-case. The endeavour to rear larvæ from this urine failed, as after three days no living forms could be found in the test tube in which the sediment had been placed, mixed with distilled water and kept at a temperature of 37° C. Great numbers of empty egg-cases, however, were present, and a very large number of larvæ must have hatched out and died. The experiment was repeated, using soft rain-water, but also failed. The rotifers, which were numerous in the rain-water, were also rapidly killed by the decomposing urine. Further experiments in a warmed miniature aquarium would be desirable.

The point is of importance because, as the case of Private J. G. shows, a man may be three years at home (this man left South Africa in 1903) and get steadily worse with the disease, passing large quantities of viable ova in his urine, some of which, at any rate, pass into the larval state. Our knowledge of the life-history of this parasite is still very incomplete. Sonsino's observations have not yet been confirmed, and we cannot dogmatically assert that it is quite impossible for any of these larvæ to attain the adult state in England. I would refer here to the case published in the Journal of the Royal Army Medical Corps by Major N. Faichnie, as well as to another published earlier by myself.

[1] Stock, P. G., "Endemic Hæmaturia," *Lancet*, September 29th, 1906.

Another question relates to the permanancy of the disease. I have now examined sixty-eight urines in forty-one cases of bilharziosis. Two of these cases I would consider certainly cured, on the ground that their urines were free of ova in 1905 and 1906, *i.e.*, 4·8 per cent. of the cases. Eight others may be cured, as no ova were present in their urines when last examined, but no definite opinion can be formed from one examination. In three cases I examined in 1905 ova were absent, but were present when the men were examined again in 1906. All these eight cases must therefore remain *sub judice* for another twelve months. How long the patients who have recovered had been suffering from the disease I am unable to state, as specimens of the urine only were supplied without information about the patients. A large mass of statistical information must, however, be accumulating at headquarters with regard to the pensioners discharged the Service for bilharziosis, which, we may hope, will be in time published, and authoritatively settle the question.

I should not venture to offer these few remarks on the subject, but that departure on foreign service prevents further observations at present, and possibly these notes may be of use to some worker.

ACUTE APPENDICITIS. PERFORATION. REMOVAL. RECOVERY.

By Captain W. E. HUDLESTON.
Royal Army Medical Corps.

Private C. was admitted to hospital on June 12th, 1906, for double middle ear disease, for which he had passed his invaliding board on September 3rd, and was awaiting departure.

On the morning of September 23rd he was seized with acute abdominal pain, associated with some tenderness in the right iliac fossa, and some rigidity of the abdominal muscles.

September 24th.—Abdomen rigid, almost motionless, and distinct swelling in the right iliac fossa, over which there is extreme tenderness; pain paroxysmal; pulse 80.

September 25th.—Abdomen quite motionless; considerable general distension; percussion over swelling in iliac fossa dull; liver dulness normal; pulse 120. Oil and turpentine enema given with no result. At 4.30 p.m. no change in condition, save for slightly increased distension of abdomen. The patient said he had no pain, but was unable to pass urine. Pulse 135, small, running. This rapidly rising pulse-rate was considered an absolute indication for operative interference, in spite of the absence of pain or high temperature, a useful "tip" which I recently acquired at St. Bartholomew's Hospital.

Chloroform was administered, the urine drawn off, and the skin

prepared in the usual way. An incision was made two inches long in the usual position over the swelling. About two ounces of sero-pus escaped when the peritoneal cavity was opened. A large, acutely-inflamed mass of omentum presented in the wound; it was almost gangrenous in appearance, and covered with thick flakes of lymph. This mass was drawn through the wound until healthy omentum appeared, when the pedicle was ligatured in small sections and the whole mass removed. The cæcum, which was attached to the under surface of the omental mass by recent adhesions, was carefully separated. After the removal of the inflamed omentum the appendix was discovered fairly easily. It was perforated about three-quarters of an inch from its free extremity. In the free extremity was a fæcal concretion, exactly the size and shape of an ordinary cherry-stone. The appendix was amputated in the usual manner, a sleeve of peritoneum being drawn over the end of the stump, and a large tube inserted through the wound, which was closed with silk sutures.

For the first three days after the operation his condition was very grave, and he had extensive peritonitis, retention of urine, and marked intestinal distension. He has now completely recovered.

The above case is considered worthy of record and of interest on account of the condition of the omentum described.

A SIMPLE METHOD OF RECOLOURING THE DIVISIONS OF THE MERCURIAL INTRAMUSCULAR-INJECTION SYRINGE.

By Lieutenant-Colonel W. J. BAKER.
Royal Army Medical Corps.

To any one who is not gifted with hyper-acuteness of vision, it will be found extremely difficult to see with perfect exactitude the divisions on the barrel of the injection syringe when the red enamel wears off, which it very quickly does, and especially if turpentine in any form is used for cleaning purposes. To remedy this, the following simple procedure will be found useful. Thoroughly heat the barrel of the syringe in the flame of a spirit lamp, then rub the markings with a stick of sealing-wax, allow the wax to cool to the consistence of dough and scrape off with a knife. The wax will remain in the engraved divisions.

The marking will remain for quite a long time and can be easily renewed when required.

It will be found that white sealing-wax is the best colour to use for this purpose, the white colour showing up far better against the grey mercurial cream than either red or black.

SEVERE INJURY TO THE RETINA ACCOMPANYING AN APPARENTLY TRIVIAL INJURY.

By Captain A. E. B. WOOD.
Royal Army Medical Corps.

Private A. was admitted to hospital suffering from an injury to the head which he had received at the rifle range while acting as marker. He stated that he had been struck in the head by a ricochet, but thought he must have been struck by a chip of a brick, and not by the actual bullet. On examination a fairly clean incised wound was seen immediately above and parallel to the right eye-brow. The wound was about ¾ of an inch long and approximately about the middle of the eye-brow. The left upper eyelid was much swollen and ecchymosed, the patient being unable to raise it; no other injury was noticed. There being no sign of fracture the wound was cleansed, stitched with horse-hair, and healed by first intention. The swelling of the left eyelid slowly subsided, passing through the various colour changes of a contused wound. As the swelling subsided, a very hard substance could be felt lying in the outer third of the eyelid, its direction being from above downwards and from without inwards, the lower edge reaching to the palpebral margin. From its consistence the idea of a foreign body at once occurred, but

there being no sign of surface injury in the neighbourhood it was thought to be possibly a developing abscess or an inspissated hæmatoma. A small incision was made over the swelling and a small quantity of pus evacuated, producing a further reduction in the size of the tumour. On the following day while the wound was being dressed a dark metallic looking substance was seen presenting; the wound was enlarged and the presenting substance was grasped with forceps and twisted out; it was found to be about the anterior half of a Lee-Enfield bullet, both core and case complete, the latter being twisted into a sharp point at the base, and so lying that the point of the bullet was directed towards the patient's nose. The bullet had evidently travelled from the wound above the right eye-brow over the surface of the frontal bone into the left eye-lid, without causing any injury to the subjacent bone and without leaving any mark of its transit. Apparently, also, in its passage it must either have rotated about an antero-posterior axis, or it must have penetrated base foremost; the latter seems unlikely because the wound above the eye-brow was not lacerated, which would have been the case if the irregular base had penetrated first.

From the accompanying drawing it will be seen that the nose of the bullet was perfectly smooth, showing no sign of impact. Probably the bullet ricochetted from its base, and in so doing produced the projection marked "A" in the drawing, which, as noted above, was felt at the palpebral margin.

As soon as the patient was able to raise his left eye-lid, he complained of partial loss of vision in that eye. On examination of the left visual field, he failed to see objects in its right half, indicating left temporal hemianopsia. On ophthalmoscopic examination a detachment of the temporal half of the left retina was found.

It is evident therefore that the globe of the eye sustained serious injury at the time of the accident, which was, however, masked by the trivial damage to the eye-lid.

My thanks are due to Captain L. H. Abbot, 11th Rajputs, for the accompanying drawing of the bullet, and to Lieutenant-Colonel E. H Lynden-Bell, R.A.M.C., for his kind permission to publish the case.

THE CARE OF THE SOLDIER'S FEET.

By Lieutenant C. R. BRADLEY.
Royal Army Medical Corps.

A famous General is reported to have said that most battles are won on the soldier's stomach; but it would have been equally true if he had said that many battles are won or lost on the soldier's feet. A soldier is quite unable to make a sudden and vigorous attack after a long forced march if his feet are tired and sore, while statistics of manœuvres, both at home and abroad, show that a very large percentage of men report sick with sore feet after every march of from fifteen to twenty miles distance, and a still larger proportion of men suffer with sore feet and do not report sick. This large percentage of "ineffectives" must considerably minimise the efficiency of the Army in war time, when the result of a battle often turns on the ability of one side to reach a point of vantage before the other, and it stands to reason that, other things being equal, the side with the best conditioned feet will get there first.

The cause of this inefficiency, which I am convinced is greater in our Army than in other large European armies, is not very hard to find, and is one that, if proper measures were taken for the care and preservation of the soldier's feet in peace time, would considerably increase the efficiency of our troops in an age when efficiency in every little detail is absolutely essential in order to command success. A recruit on enlistment has, or rather should have, a foot free from deformity or defect, and it is hard to see why his feet should not improve rather than get worse during his period of service. Yet if the feet of any infantry battalion be examined, it is quite unusual to find any man without some slight deformity.

A very obvious cause of "foot trouble" is the system, or rather want of system, of properly fitting the recruit with boots and socks on enlistment. A recruit on joining a regimental depôt is, according to regulation, supplied with two pairs of boots, which are theoretically examined as to fitness by his company officer. These two pairs of boots are to last the recruit for the ensuing year, and, taking for granted that the "fitting" of the boots has been conscientiously carried out, it must be remembered that the recruit as a rule is still a boy, and that during the year following his enlistment his foot is liable to increase in size, and as a result of this his second pair of boots may be considerably too small for him. To combat this difficulty it is the custom in some depôts to supply the recruit with two sizes in boots, his second pair being a larger size than those in use, and although this may to a certain extent overcome the difficulty, it is unfortunate for the boy whose foot does not happen to grow to the size of his second pair of boots.

The present "regulation boot" is supplied in nine sizes and four magnitudes, quite sufficient for the fitting of a normal foot, but no proper allowance is made for a soldier having some little individual peculiarity, such as an unusually high instep, very small ankle, &c., &c., which will render his marching in an unaltered "regulation boot" extremely uncomfortable, but could easily be remedied by a skilled bootmaker.

The system of "special measurements" which is allowed by regulation is unsatisfactory and often useless. This brings up the question of why it should be more necessary to have a "master tailor" to see to the correct fitting of a recruit's uniform (which any intelligent officer or non-commissioned officer is certainly qualified to do), than to have a "master bootmaker" to properly fit a recruit with boots, and to make any alterations from the "regulation pattern" to suit individual peculiarity?

The correct fitting of boots requires skill, and skilled labour should be employed for this purpose. Civilian bootmakers might be enlisted as "master bootmaker" under the same conditions as "master cook" and armourer-sergeants are now enlisted; they should not be young boys, but should be accepted up to the age of 26 or 28 years, and really good qualified men, even if married, should be accepted. This would admit of men of skill and experience being recruited from the largest and best boot firms. They could be made responsible for the correct fitting of the soldier's boot all through his service, and the deformities which we so usually meet in the soldier's foot, as "ingrowing toe nail," "hammer toe," "splay foot," "flat foot," "bunions," &c., &c., would practically disappear.

Having legislated for the care and supply of properly fitting boots and socks—I add socks, as they require quite as much attention as the soldier's boots—the next point to consider is the prevention of those common ailments to which the soldier's foot is so liable if not looked

after, and also to prepare his feet for the strain of long marches both on manœuvres and in war time. In order to successfully carry this out a more thorough system of regimental chiropodists is necessary, and by "chiropodist" I do not merely mean a man who has been instructed how to cut corns and to trim toe-nails, but a man thoroughly acquainted with all the minor ailments to which the soldier's foot is subject, and fully qualified to treat and prevent these ailments. He must be a man able to command authority, and must be "well up in," and take an interest in, his job.

Under the present Army Regulation for Chiropodists one man per infantry battalion or depôt, after having obtained a certificate of proficiency in chiropody, may be appointed as battalion chiropodist with 4d. a day extra duty pay, but he will not be struck off any duties. This man is presented with a beautiful case of many unnecessary instruments, and is then often left solely to his own devices to do just as much or little work as he likes, which in many cases amounts to absolutely *nil*. In one infantry battalion I found the chiropodist was doing the duty of "sick orderly," and had been doing so for some years. After enquiring why the chiropodist should do this duty, which kept him all day at the hospital, I was told he was a very old soldier and that they had made him chiropodist in order to give him the extra pay, but that he never did any chiropody!

To obtain any benefit from chiropodists one chiropodist per company is necessary. This man should be a Lance-Corporal or Corporal, intelligent, carefully trained, and a man who takes an interest in his work. His duties should be clearly laid down and explained to him, and every week under the supervision of the company officer the men should be paraded with bare feet, and he should inspect them as to cleanliness and any tendency to corns, blisters, &c. Any men who are subject to "scalded," "blistered," or "fired feet," should be told to "fall out," and afterwards be instructed in the method of preventing their own particular ailment. Before manœuvres or active service the chiropodist would issue to all men one of the numerous preparations for hardening the men's feet, and those men who are known by the chiropodist to be subject to any particular kind of "foot trouble" would apply to him daily on the "line of march" for advice and preventative treatment. A man who under these conditions "reports sick" or "falls out" on the line of march with sore feet, and who has not previously reported sick to the chiropodist, should be punished, as is the case in the German Army. The great mistake that most people make is to look upon the chiropodist simply as a "cutter of corns" and "trimmer of toe-nails," whilst, on the contrary, only on very rare occasions should he perform these duties, but instruct the men how to do it themselves, his great use being to instruct the men how to guard against and prevent every kind of "foot trouble," and to advise and treat any cases of "sore feet" that occur.

Unofficially, and thanks to the aid of a far-seeing adjutant, I was enabled to carry this system of "company chiropodists" into practice during the Salisbury Plain manœuvres of 1904, and to contrast the result with a regiment in which no trouble was taken to look after the soldiers' feet, and in which there was no chiropodist at all. One instance is absolutely conclusive of the superiority in marching of the battalion with the company chiropodists. A march of about thirty miles was made over bad country with a bivouac in the middle; both regiments performed practically the same duties, marched exactly the same distance, and had had the same previous training. The morning following the return to camp, the battalion I had trained in chiropody and in which the chiropodists had been supplied with powders, ointments, &c., to carry on the march, had 2·5 per cent. per company sick with sore feet, whilst the other battalion had over 25 per cent. per company. These figures are very high, but the men who reported sick were mostly newly-joined recruits and unaccustomed to marching, also it practically represented the sick of two days; but in whatever way it is looked at, it shows that much can be done to improve the efficiency of the soldier if proper attention be paid to the care of his feet.

A SHORT REPORT ON THE CUBICLES IN THE INKERMAN BARRACKS, WOKING.

By Lieutenant-Colonel T. Du B. WHAITE.
Royal Army Medical Corps.

In the year 1902, ninety-eight cubicles were fitted up in six barrack rooms as an experiment. The idea seems to have been taken from the Rowton houses, and the object in view was the improvement in the condition of living in barracks for the private soldier, and the ultimate attraction of a better class of men into the Army. There is no doubt whatever that the system is greatly appreciated by those who are fortunate enough to obtain a cubicle, but the great drawback from a commanding officer's point of view is (in this barracks at least) that a certain number of men are detached from their companies, and are apt to get out of touch with their comrades in the general barrack rooms. A better system would be to have part of a large barrack room, for one company, fitted up with cubicles, and thereby keep the men together. The loss of accommodation and the enormous expense of such an arrangement would be an effectual bar to the adoption of the cubicle system for the Army generally. For disinfection, on account of infectious diseases, they are inconvenient and require a larger expenditure of sulphor dioxide than barrack rooms, on account of their being cut up into so many small spaces, to say nothing of the enormously increased

area of paintwork to be treated by the Royal Engineers. As neither Notter and Firth nor Munson make any mention of cubicles, a short description may prove not uninteresting to my brother officers.

Three different styles of cubicles were erected; in two rooms the cubicle partitions, including the door, reach the floor on all sides; in the second model there is a space of 6 inches left beneath the door; and in the third style there is a 6-inch interval between the woodwork and the floor on three sides, the wall of the room forming the fourth side in all cases, of unplastered limewashed brick. The partitions are 6 feet 6 inches high throughout, of woodwork painted khaki colour. In two cubicles panels of a sort of *papier maché* or wood pulp material were put in, but they become disfigured by nail holes more easily than wood. The lighting is from the windows of the rooms on the first floor, and on the upper floor is supplemented by the skylights. The average window area is 7 square feet, and there is one electric light for every two cubicles. The size of the cubicles varies considerably, and is mainly determined by the position of the windows. Some have an entire window to themselves, whilst in others, the partition between two cubicles divides the window for some distance from the bottom in the first floor rooms, and quite to the top on the upper storey. This arrangement is calculated to cause friction between two neighbours, if they do not both happen to agree as to the advantages of fresh air. The men prefer those cubicles which are closed in all round, as there is no draught, and the dust does not blow in from the adjoining cubicles; but I think the movement of air in them is not sufficient to keep them sweet, and I prefer those with a space under the door, as they are better ventilated, and the draught is very slight.

The exact measurements of the cubicles are: length 12 feet 6 inches, width 5 feet, partition 6 feet 6 inches, door 2 feet wide, with 6 inches space below. Window 5 feet 6 inches by 3 feet. The average window area is 7 square feet.

The furniture of each cubicle is: an iron folding bedstead 6 feet 6 inches by 2 feet 3 inches, with a wire spring bottom. A cupboard on the wall above the bed 3 feet 3 inches by 1 foot 6 inches by 1 foot 3 inches, fitted with lock and key. The top of this cupboard serves as a shelf for clothes, &c. A small deal table (with drawer) 3 feet by 1 feet 6 inches. A Windsor chair, a hat rack with two pegs, and a rifle rack.

The men who occupy the cubicles are of good character, good shots, and smart men as a rule; in fact, the possession of a cubicle is a reward of good behaviour. I heard of one man who declined a Lance-Corporal's stripe, because he would have been required to give up his cubicle and live in a barrack room. The men decorate their sanctums with pictures, photographs, and various fancy articles, such as Japanese fans, screens, &c., and many of them look very smart with a rug on the floor, and a cover on the table. In a cubicle room the accommodation is reduced

by about one third, and the cubic space per man increased in an inverse ratio, though it appears to me the increase of space is not so advantageous on account of the interference with the circulation of the air. Where space allows, a barrack table and two forms are put in the room for general use, such as brushing clothes, games of cards, &c., but not for meals, which are taken on the ground floor in the company dining rooms. Taking them all round there is an average cubic space of 1,000 cubic feet per man. The warming is done by hot water radiators in the centre of the rooms on the first floor, and 4-inch hot water pipes around the walls on the upper floors; the men prefer the latter. There are fire places in all the rooms, but they are not used.

DYSTROPHIA MUSCULARIS PROGRESSIVA INFANTUM.

By Captain W. C. CROLY.
Royal Army Medical Corps.

The patient was a son of a Staff-Sergeant of the Supply and Transport Corps, Cannanore, India.

Family History.—The father of the patient is one of eight sons and four daughters, who are all healthy, the parents and grandparents also being long-lived and healthy. The mother is one of a family of seven girls, all of whom, as well as the parents, are very healthy. All the uncles and grandparents were very healthy and remarkable for longevity. In fact, there is nothing to show that the child's complaint is hereditary, so the father writes.

History of the Case.—The young patient, now aged 4½, was first treated in this station for convulsions, November, 1904; next in January, 1905, for a small incised wound on the top of his head, which was slow in healing, and was the result of a fall off a balcony. It was noticed by his parents that the boy was fidgety and restless, and backward for his age in nearly every way, and he could not concentrate his attention to learn his lessons. Though muscular and apparently strongly built, he could not support himself from a horizontal bar for more than a few seconds, whereas his younger brother could do so for about three minutes and pull himself up and down. He was given syrup calcii lact. phosp., and ordered to the hills (Wellington) for the hot weather with his mother and two brothers.

On May 30th, after six weeks in Wellington, the boy's walking suddenly became very bad. He could not step over a two-inch doorstep without help, and was continually tumbling down on the floor, toppling over on the back of his head, and remaining there till picked up, as helpless as a tortoise on his back. The mother states that she brought the boy to the Station Hospital, Wellington, where he was seen by Lieutenant-Colonel S. Townsend and Captain Crossley, R.A.M.C. His condition

that morning was more helpless than she had ever seen it. When laid on the floor and told to get up the boy could not rise, and his efforts were painful to watch, and when helped he "climbed up his legs." She was told how serious the boy's condition was, and advised as to treatment, &c.

On returning to Cannanore from the hills, the mother brought the young patient to hospital and stated what had taken place at Wellington; how "the boy had suddenly got ill there, which she attributed to a severe wetting, as the lad persisted in running out in the rain, often with bare feet," but "that she had never seen him so helpless as on the morning he was brought to the Station Hospital, Wellington," that he remained helpless for a week and then began to improve, and now, June, 1905, three weeks after his visit to Wellington Station Hospital, he was almost as well as ever, but is more restless and fidgety than he used to be, and cannot be taught lessons as his mind is always wandering. He complains of pain in his calves, and worries because he cannot run quickly.

Previous Illness.—His father states that he began to walk at the usual age, but seemed to do so with difficulty, and was easily tripped. This had continued ever since. He had several convulsions at the age of 1 year and 8 months, and was unconscious from 9 p.m. till 1 a.m. on one occasion, when he was given up by the doctor. This was in Rangoon. Then immediately afterwards he had an attack of epidemic dengue fever, and shortly after recovery got a second attack. The boy has since been subject to convulsions on each occasion of fever, of which he has had a few attacks.

On examination, May, 1905, his height was 3 feet 5 inches; weight 36 pounds. The boy was pale-faced, but his body was well nourished. His manner was fidgety, nervous and shy. The pupils were dilated, but reacted normally to light and accommodation. When stripped one at once noticed the well-developed calf-muscles, which measured 9 inches. The glutei also appeared to be enlarged; the pectoral muscles (costo-sternal part) and latissimi dorsi were slightly wasted. The attitude was characteristic, the legs were far apart, the shoulders thrown back, the spine curved, and the abdomen prominent. The gait was waddling (Osler), the legs were jerked forwards when he walked, the heels striking the ground. In getting up from the floor the patient "climbed up his legs" (Gowers). When one endeavoured to lift him the child seemed to slip through the hands, so that the "loose shoulders" (Erb) were marked. The patient complained of pains in his calf-muscles, and that he was unable to run quickly. There was no involvement of the face or hand-muscles. The knee-jerks were exaggerated, particularly of the right limb, but ankle clonus was not obtainable. The urine was normal. On opthalmoscopic examination no abnormalities were noticed.

Treatment.—Massage and galvanic electricity, with syrup calcii lact. phosp. and syrup ferri iodidi on alternate days were ordered, with salt-

water baths, and good, plain, nourishing diet, also gentle and regular out-door exercise.

Present Condition.—July, 1906. In appearance he is very like his mother; so is the youngest, who is a delicate child, though not showing any signs of his elder brother's trouble; the second boy, who has excellent health, takes after his father. The progress of the disease appears (as Erb states occasionally happens) to be arrested. It is now sixteen months since the sudden onset of disease, and the boy is able to run about and use his limbs nearly as well as his comrades. He came in second in a hundred yards boys' race at some sports recently held here. He is still fidgety and restless, and has made practically no progress in his education. His mother states the boy's memory is good; she only teaches him his catechism, and that he remembers very well. The difficulty is to keep his attention fixed, as his mind is always wandering. During the past sixteen months this boy has increased 2 inches in height and only gained 2½ pounds in weight. Calf measurement of each leg had increased by 1 inch, being 10 inches in March last; now the measurements are the same as when first taken in May, 1905 (9 inches). He can get up off the ground without any difficulty, but has slight difficulty in turning quickly. He stands with feet well apart, and the abdomen is prominent. The wasting of the lower part of pectorals and latissimi dorsi muscles is more marked now, otherwise no further change is noticeable in the muscles. The parents state that the boy is stronger in the arms now and can pull himself up and down, but that he trips a good deal and falls, and he is stammering much more now. He is massaged twice daily, gets sea-water baths, and is taking Parrish's food thrice daily. His general health is good. It is interesting to note that the "loose shoulders" are not now marked, and the spine not so curved. The boy can stand easily with his feet together, but prefers to keep his legs apart.

NOTES FROM THE DIARY OF A MEDICAL OFFICER IN CEYLON.

By Major F. W. Begbie.
Royal Army Medical Corps.

Medical practice in Ceylon offers ample opportunity for clinical work in all branches of the healing art. After looking through my notes of the cases that have come under my care, I have made a selection of some of those that appear to me to be out of the ordinary a little, yet not so rare that medical officers in the East will meet them not infrequently.

Case 1. *Hydatid of Liver.*—Mr. B. C., a public works officer, aged 45, the last fifteen of which had been spent in some of the most unhealthy and remote parts of the island, where food was bad and difficult to obtain. For the last seven years patient had been ailing, with no very definite

symptoms, beyond sickness after food and a feeling of great distension after drinking fluids. During his residence in the island he had several attacks of ague, of more or less severity, accompanied by jaundice. He had consulted several medical men, both at home and in Ceylon, for this complaint. Shortly before coming under my notice the patient had been obliged to take to his bed on account of inflammation of the right lung, and as he did not improve as he should have done, I was asked to see him. On first seeing the case, I had, of course, thoroughly examined the liver, which was found to be enlarged downwards over an inch, and to have a very prominent and easily-felt lower margin. Curiously enough the area of dulness appeared to extend below this border, but there was nothing of a solid nature to be felt, nor was pain elicited; only a feeling of discomfort, referred towards the centre of the abdomen. Examination of the lung revealed the presence of an accumulation of fluid in the chest cavity, and an operation for its removal was suggested and consented to by the patient. On tapping the pleural cavity fluid of a limpid character was withdrawn, a portion of the rib was removed, and a large quantity of fluid escaped. Floating in this fluid were some small white bodies, which on microscopic examination proved to be hydatids. The liver was thoroughly explored with the needle, but failed to find any other hydatid tumour, and it was believed that the original hydatid had ruptured into the pleural cavity. The patient was much relieved by the operation, temperature fell, pulse improved, and the general condition became much more hopeful. He proceeded gradually towards convalescence until twelve days after operation, when his temperature rose to 104° F., and he complained of feeling very unwell. The following day he said his liver was very painful, and he was violently sick. The presence of another hydatid was suspected, the former opening having by now almost healed. Patient would not agree to any further exploration, but two days later, as his condition was very serious, he consented. A needle was introduced in the mid-axillary line and inclined upwards towards what was thought to be the *old hydatid*, but neither there nor in the centre was anything discovered. Withdrawing the needle and reintroducing it lower down, I examined the lower edge, and then the posterior part of the lower edge, which was followed by a rush of fluid. I introduced a knife and opened up the wound on the needle, enlarging the skin wound downwards, until able to introduce a finger. This was done, and lying behind the lower edge of the liver and reaching towards the umbilicus and right kidney as far as my finger could reach was a large cavity, shut off from the abdomen, the inner surface of which was filled with small swellings, evidently daughter and grand-daughter cysts. Such a large amount of fluid had escaped during the opening up of the wound that I was unable to calculate the amount the cyst contained. A drainage tube was inserted and patient put back to bed with hot bottles, &c., but unfortunately his strength never rallied after this second operation. I performed a *post-*

mortem at the request of his friends, and removed the liver and cyst entire; they weighed 79 ounces. The cyst was as large as a small melon, grew from the posterior surface of the lower margin of the liver, and was continued upwards to the diaphragm and through this with the right pleural cavity; below it was adherent to the upper surface of the kidney and by numerous adhesions to the peritoneum, the rest of the peritoneal cavity being entirely shut off. The walls were very thick and strong, and had numerous small cysts growing from them towards the lumen. It was evident that the growth had been there for many years, and had been of very gradual expansion. It was probably contracted during his residence in the remote parts of the island.

Case 2. Operation for Ventral Hernia, in which Silver Wire was used without any subsequent Discomfort.—Mrs. D., wife of Colour-Sergeant D., married eleven years, with two children, had had two miscarriages, was admitted into hospital suffering from a ventral hernia as large as a water-melon. She gave the following history: In 1900 she was operated upon in England for a dermoid cyst of the right ovary. The operation was not very successful, and required to be re-performed at St. Bartholomew's Hospital, in London, at the end of 1901, she having been more or less an invalid during the interval. This operation was quite successful, and for the next year she suffered no discomfort of any kind. She left England in December, 1902, in excellent health, but unfortunately encountered a very rough passage during the voyage to Colombo. During one paroxysm of sickness in the Indian Ocean she felt something "give way" inside her. A few days after she noticed a small swelling opposite the place, but did not take much notice of it. In February she showed the swelling to a doctor, who recommended a belt with pressure over this spot. This she wore with benefit, but it did not stop the tumour growing, and when I saw her six months later it was larger than an orange. On examination I found an opening reaching downwards 2 inches from the umbilicus, situated in the middle line, the tissues around being soft and flabby, and the patient very stout. The tumour bulged out on coughing, and could not be entirely reduced. It appeared to be composed of omentum. She desired to be operated upon, and arrangements having been made, with the kind assistance of Lieutenant-Colonel Anderson, R.A.M.C., the tumour was cut down upon, and it was found that a portion of it was adherent to the under surface of the rectus. This was freed, and as much of the omentum as was outside was ligatured and removed, the pedicle being returned into the abdomen. No kangaroo or salmon gut being available, fine silver wire was used. The ends were twisted parallel with the linea alba, and the extremities inserted into that structure; deep silk ligatures being used to bring the muscular and skin tissues together. Although very sick from the anæsthetic for two days, the stitches held, and the patient made an excellent recovery. I saw her frequently during the next six months, and only on two occasions did

she complain of any pricking sensation from the silver wire. I heard from her ten months after the operation, and she is still perfectly well, and suffers no inconvenience.

Case 3. *Operation for Hernia.*—Private P., of the same regiment, a famous regimental boxer, one day whilst having an extra big bout, managed to rupture himself, he having, I presume, a tendency towards hernia. I was able to reduce the rupture, and a truss was fitted. Some few months later, as the rupture still came down on removing the truss, he desired to be operated upon. The usual operation was therefore performed, salmon gut being used entirely, both for the deep and superficial sutures; thus I was able to avoid the occurrence of those stitch abscesses so often produced by imperfectly sterilised silk, which caused a good deal of annoyance to many of the cases in South Africa. The patient made a good recovery, and the last that I heard of him, seven months after the operation, was that he was able to do his duty and box as formerly without the slightest inconvenience.

Of serious cases of fracture, three came under my notice and treatment during this period, and, curiously enough, two of them within a day of each other. Both bones were broken, and the right leg of each patient involved. Back and side splints were applied, with weight and pulley extension, and complete rest for three weeks, then plaster of Paris, produced results in which there was little if any shortening.

Several cases of midwifery and gynæcological interest occurred.

Case 4.—I was called to attend a coolie woman, and assist a Burgher doctor, at 2 a.m., in a hut 12 feet long, in which there were six other inmates; two of whom were cooking over a stove, while the patient lay in an opposite corner of the room, with the waters ruptured several hours, and a hand and a foot presenting. It was only by the introduction of the whole hand and by bipolar version under an anæsthetic that delivery was effected. Seven days later I saw the woman sitting in the street, as if nothing had happened out of the usual routine of life.

Another case illustrates the great difficulty residents have in procuring the services of a medical man in emergency cases, owing to the great distances.

Case 5.—I had been asked to attend a lady in her confinement, which was expected two months later, and for which she was coming into the town. A few days later a coolie messenger arrived at night to say that the lady was seriously ill, and would I come at once. After a drive of eighteen miles, over very hilly country, and a walk of a mile from the cart road to the bungalow, I found the lady had been confined of a seven-months' child at 9 p.m. the previous evening. Mother and child were lying on the bed still connected by the umbilical cord at 5.30 the following morning. The husband and relatives had not the slightest idea what to do. Luckily both mother and child survived the experienc ,

and the latter, after some months of life in cotton-wool, grew into a fine healthy baby.

But it is in the region of gynæcology especially that there is a large field in Ceylon. Owing to the enervating climate of the low country and the sea-coast, and especially amongst the wives of soldiers, uterine complains are common, caused in a large measure by rising too early after confinement. The diseases most common are retroflexions, chronic endometritis, and salpingitis, with its sequelæ, hydrosalpinx and hæmatosalpinx. Of "pin-hole" os uteri several cases have been treated by dilating the os.

Regarding the general symptoms, the patient comes complaining of a feeling of weight in the pelvis, worse on standing, constipation, constant desire to pass water, a white discharge, and that inevitable symptom of uterine complaints, pain in the back. There is also a peculiar look about the face which bespeaks a uterine complaint. Several of these cases have been treated successfully, both in private and in military practice, by rest, dilatation of the os, and a thorough curetting of the uterus; whilst a most successful adjunct to treatment in retroflexions being half an hour in the genu-pectoral position every day. In the more serious cases of hæmatosalpinx it is best to advise the patient to go to England. One case of this sort, whom I temporarily relieved by curetting, I heard from a few days ago, she having had the tumour removed *per vaginam* at St. Bartholomew's.

PUERPERAL SEPTICÆMIA CAUSED BY RETENTION OF PORTION OF PLACENTA AND MEMBRANES: OPERATION AND RECOVERY.

By Lieutenant-Colonel J. D. RECKITT.
Royal Army Medical Corps.

The following case may be of interest to those who are engaged in gynæcological and obstetric work.

About 10 p.m. on October 13th, 1903, at Woolwich, Lieutenant (now Captain) H. T. Stack, R.A.M.C., asked me to see Mrs. M., aged 36, multipara. She had been attended in her confinement, *thirteen* days previously, by a midwife. The patient was living in lodgings. Lieutenant Stack reported that he had been called to see the patient the day before, that she was losing much blood, and that she seemed to be in a dangerous condition, from what he thought was septicæmia.

I found the woman in a very weak condition, extremely blanched, with a thin and rapid pulse, and with a temperature of 104·6° F. The midwife had been sent away by Lieutenant Stack and instructed to cease attending cases of midwifery, but I ascertained from a woman in the house, and who was present at the delivery, that the midwife had

extracted the placenta, and I concluded from this that in all probability a portion had been left *in utero*. This conclusion seemed to be quickly verified on making a vaginal examination, for not only was there very free hæmorrhage (which had been going on since delivery), but the stench from the discharge was extremely offensive. I found the os fairly patulous, but could not feel any protrusion of placenta or membranes The condition of the patient was so grave that we at once decided to explore the uterus under an anæsthetic, and I directed Lieutenant Stack to obtain what we required, viz., chloroform, irrigator, antiseptic lotions, glass uterine tube, Hegar's dilators and curettes. Under chloroform, and with the patient in the lithotomy position at the edge of the bed, and having irrigated the vagina with warm Condy's lotion, a finger was easily passed into the uterus, and by pressure externally the cavity was brought within reach. Some placenta and membranes in a horribly fœtid condition were detached from near the fundus, but I could not quite reach one fragment, and therefore was compelled to use the curette, which I did with every care. It was not necessary to dilate the os. The glass tube was passed into the cavity of uterus, which was very freely irrigated with hot carbolic lotion (1 in 100). The patient passed a comfortable night, and next morning her temperature had gone down to 102° F. She was kept at perfect rest in bed, on a suitable diet, given quinæ sulph., grs. v., with liq. strychniæ, ♏ v., three times a day, and on the third day, after clearing out the uterus, her temperature was 99° F. She subsequently progressed favourably in every respect, except that the anæmia remained for a considerable time.

Remarks.—This case would seem to point to the moral recently inculcated by Dr. Horrocks in his lecture on the physiology of natural parturition, and particularly where midwives are concerned, namely, to leave Nature alone as much as possible. Of course, whether or not the placenta was adherent at the time of labour we could not tell; but, in view of the rarity of such a condition, most probably it was not, and no doubt this particular midwife, instead of waiting a reasonable time, acted according to the lessons she had learnt in the over-meddlesome school. To judge from the patient's condition the result was very nearly disastrous.

The above case also bears on the remarks made by Dr. Bert Jordan in the *British Medical Journal* of May 26th, 1906, with regard to the view that routine midwifery should be left to midwives. Providing she is a thoroughly competent person, and understands well how to deal with this third stage, *normal labour cases*, or the great majority, can probably safely be left to her; but she must be able to discriminate, and at once seek the more skilled and advanced aid of the obstetrician where necessary.

INTERESTING CASES OF PRIMARY TUBERCLE IN ORGANS OTHER THAN THE LUNG.

By Major F. SMITH D.S.O.
Royal Army Medical Corps.

These cases occurred in negroes at Sierra Leone, and are published in illustration of some of the difficulties of diagnosis in countries where malaria, liver abscess, and other tropical disorders prevail.

The notes are taken from the official records. Case 1 was in hospital under my charge, but was in the immediate care of the medical officer named. I examined the cases in consultation, and assisted at the operations. I was present at the first *post-mortem* and made the second alone.

Case 1. Tubercle of the Pericardium, with Hydro-pericardium which was Mistaken for Pleural Effusion.—Private ——, West India Regiment, aged 24. (Case in immediate care of Civil-Surgeon A. T. Latchmore.)

The patient was admitted for bronchitis on June 28th, 1901; died on July 29th, 1901. Dr. Latchmore notes that on the third day the bases of both lungs were dull on percussion, especially the left, and that "on the sixth day the dull area on the left side extended forwards and merged with the cardiac dulness. Up to this point the breathing had not been interfered with to any remarkable extent, but during the next few days it became gradually impeded, and on July 14th an aspirating needle was inserted into the 9th intercostal space on the left side internal to the angle of the scapula, and 64 ounces of blood-stained fluid removed. The cardiac impulse was seen to be a little to the right of the sternum, but the cardiac sounds were very faint. The pulse improved considerably after the operation and patient's general condition became distinctly better, although pneumothorax was evidenced on the left side in place of fluid. It was thought that the condition was due to rupture of a portion of lung tissue by violent coughing. The patient, however, never rallied completely, gradually got worse, and died on July 29th. The sputa were frequently examined for tubercle, but with negative results."

The case lasted exactly one month. Temperature was above normal for the first week; highest point, 103° F. Afterwards it became lower, irregular, and frequently subnormal.

Post-mortem Examination. "*Lungs:* Right acutely congested; small scattered tubercles over pleura at margin of lung; exudes frothy, semi-purulent fluid on section. No consolidation. Pleura bound down with recent adhesions; about 8 ounces of bloody serum in pleural cavity. Left lung completely collapsed, size of spleen, alike in appearance and colour. Pleura healthy in relation to lung, but firmly adherent, and greatly thickened over pericardium, from which it is impossible to separate it. Tubercular nodules were observed in the collapsed lung.

Heart and pericardium: The pericardium filled the whole of the left cavity of the chest, compressing the lung into a small space behind; about 20 ounces of sanguineous fluid distended the sac, which was thickened to nearly ¼ of an inch. Heart muscle pale, surface of heart covered by thickened granulations and tubercles, valves healthy. The sac of the pericardium was only moderately distended by the 20 ounces of fluid, and evidently had contained much more before being aspirated. The condition exactly simulated left pleural effusion, and evidently the fluid had been drawn from the greatly distended pericardium and not from the pleural cavity. The other organs were quite healthy with the exception of the left kidney, which had two old puckered scars under the capsule on the posterior surface. A thrombus occupied the left femoral vein. The disease was evidently an acute tubercular pericarditis."

I am indebted to Captain J. B. Forrest, R.A.M.C., Officer Commanding Station Hospital, Mount Aureol, for permission to publish the following case:—

Case 2. Tubercle of the Liver, Spleen, Pancreas and Pericardium, probably Synchronous with Tubercle of the Lung; Case gave Rise to a Suspicion of Liver Abscess.—Private ——, West India Regiment. (Case latterly in immediate care of Captain F. E. L'Estrange, R.A.M.C.)

Patient was admitted to hospital for fever on September 3rd, 1904. On one occasion, the fourth examination of the blood, malarial parasites are said to have been found by Captain L. F. Smith, R.A.M.C., who was then in charge of the case. Temperature fell to 98·6° F. on the fifth day. Patient then complained of pain in the region below the right axilla, where there was slight dulness, diminished movement, and loss of vocal resonance; expectoration of mucus only. There seemed to be slight bulging or puffiness of the right side of the lower part of the chest.

A fortnight after admission attention was directed to the liver, which was enlarged and tender. Liver and pleura were explored by Captain Smith with the aspirating needle; neither pus nor fluid was obtained. Temperature in the meantime had risen and continued irregular. Examination of sputum on September 30th is said to have given a negative result. On October 15th crepitations were audible at the base of the right lung. On November 5th Captain Smith diagnosed tubercle of lung on the clinical evidence.

Towards the end, which came on December 5th, Captain L'Estrange notes that the patient had attacks of dyspnœa and diarrhœa.

Post mortem.—Body not much emaciated. *Abdomen:* Clear serous fluid in peritoneal cavity. *Heart and pericardium:* Adherent, except where separated by pus; pericardium ¼ of an inch thick. *Lungs:* Right pleura adherent in whole extent; no pus. Lung a consolidated mass of greyish friable material about to break down, dots of pus here and there, no cavities. Left pleura not adherent; lung sparsely but generally scattered with tubercles. *Liver:* Enlarged, adherent to dia-

phragm posteriorly, infiltrated throughout with tubercle, here and there small abscesses up to $\frac{1}{3}$ of an inch in diameter. *Spleen:* Enlarged and studded with tubercles. *Pancreas:* Full of miliary tubercle; an abscess $\frac{1}{2}$ an inch in diameter. Some glands enormously enlarged, especially those adjacent to pancreas. Intestines not examined. Stained smears of the lung, liver, pancreas, and pericardial pus showed many tubercle bacilli.

A SUGGESTION FOR THE EXAMINATION OF CERTAIN PROPOSED RECRUITS BY A MEDICAL BOARD AT COMMAND HEADQUARTERS.

By Major A. L. BORRADAILE.
Royal Army Medical Corps.

To most medical officers who have much experience in examining recruits it must at times occur to reject a man because of his failure to attain to some particular standard, though in their independent judgment he is capable of making a useful soldier. I would not advocate a greater discretion being left to the individual medical examiners, as that policy has been tried in the past and with unsatisfactory results, but I think the present system might be rendered more elastic by allowing recruits who, in the opinion of an examining medical officer, are likely to make good soldiers, but whom he is debarred from passing owing to deficiency of teeth, a stiff finger-joint, &c., to be brought before a medical board at headquarters of the command. To render this course as expeditious as possible, such a man would be sent at once to the headquarter station, notification to the Principal Medical Officer and regimental authorities being made by telegram, and a board there assembled not later than the day following his arrival. In this way expense, loss of time, and correspondence would be reduced to a minimum. To a medical board presided over by a senior officer might safely be entrusted a discretion in the application of certain arbitrary standards of physical fitness, and as a result I think that a certain number of men who under the present rules must be rejected, would be found fit for service, and the loss of them to the Army thereby prevented.

CLINICAL NOTE OF THE VALUE OF HYOSCINE IN THE TREATMENT OF CONVULSIONS FOLLOWING HEAT-STROKE.

By Captain S. O. HALL.
Royal Army Medical Corps.

Sergeant —— was admitted on the night of May 18th, 1905, suffering from heat-stroke. On admission he was unconscious, pulse 130, respirations shallow and stertorous, and temperature in axilla 110° F.

He was at once rubbed down with ice, placed in a wet pack, and the temperature reduced to 100° F. Patient now appeared easier, but as his pulse was still very quick and bounding and his face rather cyanosed, 5 ounces of blood were removed by venesection, artificial respiration begun, and a blister applied to the nape of the neck. After this treatment the patient improved slightly; the respirations were deeper and less laboured, and the corneal reflex returned for a time. About an hour later the temperature again began to run up; the patient vomited a lot of mucus, and contractions of various muscles, with opisthotonos, supervened. The temperature again being reduced he was given a hypodermic injection of tinct. digitalis, ♏xx., and he fell into a drowsy state, in which he remained for some hours. Next morning, about 8 a.m., although the temperature was only 100° F., he was seized with very severe convulsions, and a hypodermic injection of hyoscine, followed by another in half an hour, was given, which seemed to control the convulsions very effectually, as he had no recurrence afterwards. After this the temperature gradually dropped to normal in the course of a few days, and gave no further trouble; but on the fifth day the patient developed peripheral neuritis of the lower extremities with the usual signs, tenderness of the calf muscles, loss of knee-jerk and foot-drop being present. This condition, however, has improved a good deal, and the patient is now able to get about without the use of a stick.

The case is interesting owing to the high temperature, and also as showing the marked effect of the hyoscine on the convulsions.

I am indebted to Lieutenant Macrae, I.M.S., for his help in the treatment of the case, and also for the examination of the blood, in which no malarial parasites could be found.

A CASE OF MYXŒDEMA FOLLOWING A GUN-SHOT INJURY TO THE NECK.

By Lieutenant-Colonel R. C. COTTELL.
Royal Army Medical Corps.

The patient, R. W., married, aged 39, a pensioner employed as office messenger in the Royal Hospital, Chelsea, first came under my care on October 4th, 1906. He then had a typical appearance of an advanced case of myxœdema. Face large, puffy and expressionless, with patches of heightened colour, and small vessels in the centre of either cheek. The puffiness was most marked around the eyes, so much so that he could scarcely raise the upper lids. The lips were large, cheeks baggy, and saliva was dribbling from the corners of his mouth. His tongue was much enlarged and very flabby. Speech slow and jerky, and he articulated as if he had "a plum in his mouth." His whole body and limbs, even to his fingers and toes, were swollen. He stated that

his legs and feet were much more swollen after exercise. He had a few hairs on his upper lip and a little thin hair above both ears, some of which he had trained over the top of his head; otherwise he was quite bald. He had no eyelashes or eyebrows, "did not need to shave," and had no hair on any part of his body. Perspiration was very profuse, especially over the head, large drops continually collecting on his head and then running down his face and neck. He stated that the perspiration was much greater at night, and even on slight exertion. His pulse was soft and compressible. His heart somewhat enlarged; sounds soft and clear, and regular in rhythm. The other organs of the body were apparently healthy. On walking he advanced more or less on his toes, half stumbling, like a very old man. He described himself as getting weaker day by day, and stated that he could no longer walk any distance on account of "the weakness in his legs and palpitation." He stated that his appetite had become very poor and that he had frequent pain in the stomach after food; that he felt languid and very low-spirited. In the office where he was employed as messenger it had been noticed that he was becoming more and more feeble, mentally as well as bodily, and was more or less unfit for work.

Previous History.—He was a gardener by trade. He enlisted in the Royal West Surrey Regiment in May, 1889. Previous to enlistment he had had very good health, and he states that nothing at all similar to his present condition had been noticed in any member of his family, everyone being "strong and well." In 1895 he was eight days in hospital for "primary syphilis," and in the same year, at Umballa, he suffered from "heat apoplexy," shown as "severe attack" in his medical history sheet. He quite recovered and was transferred to the Reserve in 1897. Conduct and character "very good." He was recalled to the Colours in October, 1899, and proceeded to South Africa. He was present at several fights on the Tugela River, and on February 18th, 1900, he was dangerously wounded at the battle of Monte Cristo. He remained in hospital until May, 1900, on account of the wound, when he was sent home to Netley and was given sick furlough from there, the wound having quite healed. He reported himself at the expiration of his furlough at the Military Hospital, Rochester Row, in August of that year, and was admitted there because it was seen that he was suffering from myxœdema. This is the first notice of the disease. He was kept under treatment with "thyroid extract" for eighty-five days. He was then discharged as "much improved."

In October, 1903, he came before a special invaliding board at Chelsea, and was certified as suffering from "myxœdema and the effects of a gun-shot wound." He was again seen at Chelsea in April, 1904, and noted as showing "no improvement." "Bright red patches on cheeks, lips livid, tongue large and thick, articulation difficult, hands and feet painfully cold." It is to be noted that he had no treatment

since leaving Rochester Row Hospital in November, 1900, until I saw him in October, 1906.

Treatment commenced on October 4th, 1906. At first he was much averse to trying any treatment, as "nothing seemed to do him any good." I persuaded him, however, to take one "tabloid" of thyroid extract (Burroughs and Wellcome), gr. 5, every morning at 9 a.m. in a cup of milk.

On October 11th my note states, "feels brighter and is stronger on his legs. Bowels open rather freely; has headaches and some tendency to colicky pains. Ordered the 'tabloid' at 8.30 a.m. instead of 9 a.m., to be nearer his breakfast, which is at 8 a.m."

October 18th.—"Face decidedly less puffy, especially under the eyes. Expression is brighter and speaks less thickly. Abdomen noticeably less tumid. The legs much stronger; no headaches or colic.

November 1st.—"Can now walk easily to and from his home at Clapham daily (2½ miles each way). All sweating at night has stopped. No further dribbling of saliva from the mouth. The skin of his face is much wrinkled, but is more healthy looking. He takes his food well and has no symptoms of indigestion."

November 8th.—"The ulna side of the left hand has become suddenly œdematous and tender. All treatment omitted."

November 12th.—"The left foot and ankle have become swollen and painful. The hand is better."

November 16th.—"The hand and foot again quite normal."

While these swellings lasted there was no rise of temperature, and the patient did not feel ill in the least. The cause of these local swellings was, I think, the drug, but I do not understand why the toxic effect should have been so very local, the general system showing no ill-effects; and then, again, its curious limitation to the left side.

From November 16th I again put him on the drug, but only permitted him to have a 5-grain "tabloid" every other day. This dose he is still (January, 1907) taking.

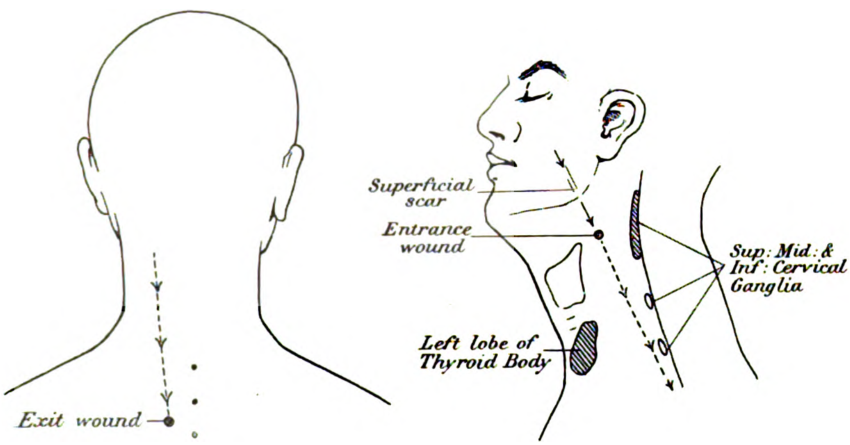
On November 20th it was noted that "he was progressing very well, his speech clear, and 'hesitation' almost gone." His hair, as a fine down, is growing all over his head. Eyebrows and eyelashes are also growing, and the hair of the body generally is steadily returning. Some sweating of the head persists. He is very strong and walks easily to Clapham and back."

December 20th.—"In every way the patient is a different man. He is bright, intelligent and quick, and is very proud of having had to shave himself and have his hair cut for the first time for six years."

The above account is interesting as showing in these cases the wonderfully rapid power the body has of recovering its normal state on the administration of thyroid extract, even after six years of malnutrition. There is, however, another point in this particular case,

and it is the real reason why I have thought its history worthy of record. I refer to the wound that he received on February 18th, 1900, and the fact that the disease, myxœdema, dates from immediately after the infliction of this wound. In other words, I consider the bullet in its course so damaged the structure of the thyroid gland that to a large extent its healthy secreting power was seriously affected.

The patient was one of a company of the battalion on the extreme right of the attacking force; the company had to try and cut off the retreat of the Boers. As many as fifty of the men of this company, the patient tells me, were wounded. The men advanced in a stooping position, the Boers being to their left-front in the hills above them. The patient says he was half stooping and walking towards the Boer position, looking up at it, when he was struck, and he did not remember any more.



The line of the bullet is very well shown by putting the man in the position he says he was in and noting the angle of the scars on the left side of his face and neck and the exit wound immediately to the left of the body of the second dorsal vertebra. The direction of the track of the bullet is therefore downwards and backwards at a very acute angle to the spine. On referring to "Gray's Anatomy" it is seen that the damage caused by the bullet could not have affected the blood supply, that is, the amount going to the gland, as the vessels are too plentiful and anastomoses too free. But on looking up the nervous supply we find several very interesting points: (1) The spinal nerves join the sympathetic ganglia on the sides of the vertebræ. (2) The inferior cervical ganglion lies between the base of the transverse process of the last cervical vertebra and the neck of the first rib. (3) The chief thyroid branches come from the middle cervical ganglion.

(4) The superior cardiac from the superior and middle cervical ganglia gives branches to the thyroid gland. (5) The cervical ganglia are all intimately connected together. The bullet in its course, therefore, could hardly escape injuring the left inferior cervical ganglion, and perhaps the middle cervical, and certainly a great many of the nervous connections of the left lobe of the thyroid body.

There is, of course, the difficulty that the thyroid gland is a double gland, and there is no reason that the ganglia on the right side should not be quite capable of doing their work. However, I think that it is quite within the realm of possibility that the injury to the nervous supply of the left half of the gland caused such a diminution of, or other alteration in, the output of the material from the gland—which appears to be necessary for the proper assimilation of food by the body—that personally I feel that the patient should have the benefit of the doubt (for in his case it may mean a larger pension), and I therefore give it as my opinion that the myxœdema was due directly to the injury to the nerve supply of the thyroid gland.

I insert illustrations showing the position of the scars and direction taken by the bullet.

Travel.

TRAVEL AND SPORT IN TEXAS, U.S.A.

By Lieutenant-Colonel R. H. NICHOLSON.
Royal Army Medical Corps (R.).

Leaving Liverpool on August 14th, 1906, on board the s.s. "Irak," Gulf Transport Line, I arrived at Galveston, Texas, in twenty days, and returned on board the same ship, arriving at Liverpool October 16th, which gave me three weeks' Tarpon fishing. There are several other ways, viz., *via* New York, thence by the Mallory Steamship Line, leaving that place every Wednesday and Saturday, taking about six days; or by rail to Galveston, which is the best route if time is limited. The Harrison and Leyland Lines also go direct from Liverpool to Galveston, but all these lines are dependent on cotton and other freights, so that they have not definite sailing days. The Mallory steamers leave Galveston for New York every Wednesday and Saturday. From Galveston the Santa Fe Railway takes one to Rockport *via* Heuston, Kennedy and Gregory; there is a steamer from Rockport to Tarpon, Mustang Island, the fishing place. There is, I believe, a new and more direct

line from Galveston to Tarpon in course of construction. The cheapest way to reach Galveston from Liverpool is by the direct steamers.

The Tarpon, *Megalops thrissoides*, or, in America, *Tarpon atlanticus* (Curier and Val), differs very little from the East Indian *Megalops cyprinoides;* they both belong to the natural order *Elopidæ;* they are very closely allied to the herring family (*Clupeoidæ*). The American local names of the Tarpon are silver king, savanilla and grand ecaillé, or big scale.

In America the Tarpon is found along the Atlantic coast from Long Island to Brazil, but not in sufficient quantities north of Florida or the St. John's River to assure sport; in the waters above the southern part of the peninsula, or on both sides, it is very common, but not plentiful, or on the extreme outer reef from Key West to Loggerhead. On the Florida coast the best known localities for them are from St. John's to Byscayeme, Indian River, Lake Worth and Fort Meyer; other localities are Captiva Pass, Boca Grand Pass, Naples, Pine Island and Homassossa. Naval officers have told me that the Tarpon is caught by the natives at Sierra Leone.

The Tarpon is a magnificent fish, and is probably pelagic, moving north over the vast area of the Gulf of Mexico; one pronounced migration is along the coast from Mexico, and so reaching Louisiana, the other possibly passing up the Windward Islands of the West Indies, so reaching Key West, and thence up the Atlantic Coast of America; around Cuba, Jamaica and other islands some Tarpon are found, but they are more plentiful in summer at the Florida points; "schools" have also been seen all the winter between Key West and Cape Florida.

They appear in February, increasing in numbers in March, April and May. The Tarpon arrives at Tarpon, Mustang Island, lat. 27° 50′ north, early in March, coming from the south, and have all left for the south again by November 16th, after which the "Tampico" (Mexico) season begins. From the middle of April to the middle of May (Holder) they do not appear to take any bait; probably this is the spawning season, which is common to many fish; an odd one may do so, as there is always fish in spawn up to August 15th.

The best fishing season for Tarpon is June and July, but in these months the sharks are so numerous that they take five out of every six Tarpon hooked; then October up to November 15th, which months have the following advantages, viz., it is much cooler,

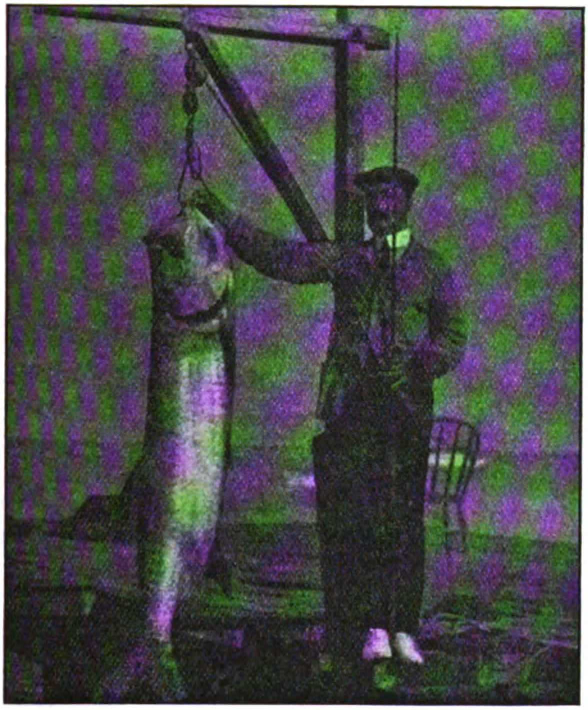
the sharks are absent, and there are fewer people staying at the inn. The boatmen say the fish fight best in October and November, having recovered from the effects of spawning, but they are magnificent sport at all times. I have heard of Tarpon being in the Orange Walk River, British Honduras, when I was stationed there, which was 70 miles from its mouth.

The Tarpon attains a length of 7 or 8 feet, and a weight of 400 lbs. (Holder). Everman states that one of 383 lbs. was taken on a harpoon. The record on a rod and line is about 300 lbs. There is a useful formula for arriving at the weight of a Tarpon, which is, multiply the length in inches by the maximum girth in inches, squared, divided by 800; this will give the weight in pounds.

Much valuable information can be obtained from a book, "The Big Game Fishes of the United States," by Mr. Charles F. Holder (American Sportsman's Library, edited by Caspar Whitney, New York: The MacMillan Co.; London: MacMillan and Co., 1903; through Messrs. Farlow and Co., fishing tackle makers, the Strand; or through the Army and Navy Stores).

Arriving at the village of Tarpon from Rockport by the "Dolly Gray" on September 6th, I started on this very fascinating sport —Tarpon fishing. That morning I essayed my luck, and was rewarded by a leaping shark, about 50 lbs. I had no idea that this fish was such an excellent fighter; taking 80 yards of line with a rush, up he went into the air, and gave me twenty minutes of sharp, hard fighting. Next day I was in partial luck and realised what a Tarpon was. In the morning I got into my first Tarpon: with a whirr, out flew the line, and up into the air went the fish, a bar of silver; with the thumb break on there was no checking his rush; again he went up into the air, shaking his head, and the wire parted. I was fishing with No. 12 nickel-plated piano wire, which is light for Tarpon fishing, being the size used for mackerel, as I always like to give the fish a chance. Some people never use wire, and later on I will discuss its advantages and disadvantages. In the evening I hooked and played another Tarpon, about 6 feet long, and nearly had him played out, when suddenly the fin of a shark appeared, and he swallowed the Tarpon whole. I should judge the shark's length to have been about 18 feet. One fascination of Tarpon fishing is one never knows what one will get on one's hook; jack fish (*Caranax hippos*) seize the bait, which may be suddenly exchanged for a shark, as happened to me: I had just hooked a jack, when the feeling was changed to that of a shark

of great weight and power: he towed the skiff about two miles, taking line from me steadily; in return I pumped him, and being fatigued by the ordeal I handed the rod to the boatman; he ultimately broke the hook in the fish. As far as I could judge his length was about 10 feet; but it was dead and hard work. In all I killed fourteen Tarpons in three weeks; there were only two or three days on which I did not have a Tarpon. Immediately one is hooked it jumps into the air. My best Tarpon was 6 feet 5 inches



The Tarpon.

in length and weighed 108 lbs. Some days I landed two fish; up to the last two days I landed nearly half the fish I hooked; on the day before I left I hooked five Tarpons and lost all, and on the last I hooked and lost twelve of them.

All the Tarpons I hooked fought with a true sporting instinct, running over 200 yards of line, and jumping on an average 12 feet into the air, in some cases shaking their heads till they got rid of

the hook; nothing can be done for this. Some sportsmen advocate a light line and never dropping the point of the rod. I tried this against my conviction, with the result that the fish broke the line. I afterwards played them as I would a salmon, viz., dropping the point of my rod when they jumped, and got no more broken lines.

The advantages of wire are that it is finer than moose hide or line and is not so likely to be seen; its disadvantage is that if a shark gets on he cannot bite the wire as he can moose hide or line, and so one is ridded of a pest. I believe the latter is used in Florida in still fishing (bottom fishing). The wire I used as mentioned before was No. 12, but No. 15 would be better, being a shade thicker.

Some sportsmen use leads in trolling, twenty-three to the pound, such as Archer Sardine, but I prefer fishing without them.

A short stiff rod is the one used, of split cane, greenhart, noib or bethabarer wood, 7½ feet long, so as to give the fish a chance. There is a doubt if a whippy rod is of any use, the Tarpon's mouth being hard and bony. A great deal of resistance is necessary to implant the hook into his mouth. The wooden rods cost 15 dols. in the States; the cane ones in London £3 10s. at Carter and Co., St. Johns Street, and Rosebery Avenue. *Line.*—No. 15 or 18, of standard Irish linen, made by Mills, of New York, tested to pull 30 to 36 lbs., is strong enough for a skilled angler. For Jew fish and other heavier fish, No. 24, tested to pull 48 lbs. The Americans seem to make these lines best. They should not be dressed. *Hooks.*—A special and large hook is used—a 10/o Limerick size, a Van Vleek, or an Oshaughnessy. *Swivels.*—A large box special swivel is the best. *Winch.*—A large multiplying winch to hold a minimum of 200 yards of line, with a patent brake, called the Ravebeth, price 5 dols., made by Messrs. Meiselbach Brothers, Newark, New Jersey, is excellent. Some people who have a powerful thumb use a brake of moose hide. The winches cost 15 dols. to 75 dols. in the States. *Artificial baits.*—A spoon of large size might be useful when bait is scarce. *Clothes.*—The maximum temperature in the summer in the shade is 90° F. to 100° F.; in September 80° F. to 90° F.; in November, when the "northers" blow, the temperature sinks very rapidly. *Banks.*—The First National Bank of Galveston has a branch at Rockfort, 15 miles from the Tarpon Inn. *Other fishes.*—There is a great variety of fish, from the Jew fish, which attains a length of 7 feet 3 inches long, with a girth of 5 feet 9 inches, to the Spanish mackerel, and one never knows what one will get on the hook.

Where to get tackle.—Tarpon tackle can be got in England, but as they know more about the fishing in the States, it is best to get it there. Messrs. Mills and Sons, 21, Park Place, New York; E. Van Hoffe, 95 to 97, Fuller Street, New York, and Mr. Cotter, Tarpon Inn, Mustang Island, Texas, sell tackle. At home, Messrs. Farlow; Army and Navy Stores; Messrs. Little and Sons; and Messrs. Carter and Co., all sell tackle; but at the Tarpon Inn it can be hired for 75 cents. a day.

Record Catch.—The record catch of Tarpon in one day is twenty-four.

Sunburnt Lips.—A solution of tannin in alcohol is very useful.

Shooting.—From the middle of October one has the advantage of snipe, duck and quail shooting, as well as Tarpon fishing.

The village of Tarpon is the best spot for fishing, as there are skilled fishermen; but they are found at Mission Bay and Corpus Christi, so that if one gets tired of fishing for Tarpon at one place they can get a change of scenery.

Expenses.—I was fortunate to meet with hospitality, and people put me up, so that my expenses were much reduced. The fare from Liverpool, return, is £29 10s. per Gulf Transport Company, 17, Water Street. Railway fare from Galveston to Rockport, return, 11 dols. Sleeper each way, optional, 2 dols. Express to station (which is the charge for transporting baggage from each point), 1 dol. Motor boat, Rockport to Tarpon, return, 2 dols. Boatmen, per day, including boat, 2.50 dols. Hotel, per diem, (14 dols. per week), 2.50 dols. Whiskey rye, per bottle, 1.50 dols. Scotch, Buchanan, White Seal, 2 dols. Breakfast on railway, 50 cents. Dinner on railway, 50 cents.

Two month's leave would give three weeks' fishing going *via* Liverpool and Galveston; *via* New York about a week more.

The exchange is about 4·82 dols. to 4·85 dols. to the sovereign. The cost of two month's leave would be about £85, exclusive of buying the tackle and rods.

Tarpon fishing is a most fascinating sport, and can be done at the time of the year when salmon fishing is out of season, if desired.

TWO MONTHS IN KASHMIR.

By Captain T. H. STEVENSON.
Royal Army Medical Corps.

I had been lucky enough to obtain two and a half months leave in India from the middle of October, and the question was, where to spend it; whether to assist at the obsequies of the dying season at some hill station, or brave the cold in the snowy ranges of Kashmir, and achieve one ambition of every Indian sportsman by bagging a "bara-singh," or Kashmir stag. I soon decided on the latter course, as October and November are generally considered two of the best months for shooting in Kashmir, for, in addition to to "bara-singh" you may get red bear, black bear and leopard, while the chakor and wild-fowl shooting are of the very best, and all this to be found within five or six marches of the Valley of Kashmir. So I hastily packed up the necessary camp kit, and sent my servant off four days ahead of me with all the heavy baggage, giving him orders to engage a pony "ekka" at Rawal Pindi, and stop at Baramulla until I picked him up there. By this arrangement I was able to travel light, with a roll of bedding and guns, and do the "tonga" journey from Pindi to Baramulla in a day and a half by the mail "tonga," in which one is only allowed 20 lbs. of baggage. On reaching Baramulla I found my servant, who had arrived on the previous day, awaiting me, and with him the two "shikaris" I had engaged, my European stores ordered from Srinagar, and such indispensable articles as cooking-pots, "puttoo" socks and gloves, Gilgit boots and "chuplies" or sandals.

My Mahommedan servant, Hakim by name, had a pitiful tale of woe to tell me. He was rather a smart "boy," but at the prospect of the tremendous journey to the unknown land of Kashmir he had quite lost his head with excitement, and had made such a mess of the "tiffin-basket" I had given him to pack, that I had to excuse him from taking any further part in the preparations. I had provided him with warm clothes and extra blankets before he left, telling him how cold it would be and to be very careful of his clothes. Imagine my surprise to see him come up shivering in his cotton garments, and to hear that he had lost all his warm ones on the railway journey to Pindi. A little judicious cross-examining, added to a knowledge of Hakim's great failing, a love of the dice, soon unravelled the mystery. Like most Indian servants he was an inveterate gambler, and it was inevitable that he should spend the long hours in the railway train playing at some

game of chance. Fortunately, his loyalty to his master prevented him from venturing the money for the "ekka," or I should have probably found him stranded at Pindi.

I hired a "doonga," or small house-boat, and left Baramulla the same evening, and tied up at Sopor on the following day. I had an amusing experience with the village "thanadar," from whom I requisitioned a couple of boatmen to assist in navigating the boat across the Wular Lake. He was an old Sikh pensioner, very fierce and truculent-looking, and he came to my boat to pay his "salaams." We conversed on things in general, and the delicate way he led up to the liquor question was a lesson in diplomacy. Then he reached for a bottle standing in the corner behind a "kilta," and when he found it was chutney his chagrin was only equalled by the easy manner in which he passed it off and tried the next bottle. This happened to contain kerosine oil for the ships' lamps, so I took compassion on him and opened a bottle of whiskey. He had two tremendous stiff "pegs," into each of which he flicked a few finger-loads of muddy water by the easy method of dipping his hand overboard as he sat upon the cabin floor. He almost finished the bottle, and I fear he must have been responsible for the unseemly commotion which occurred in the village that evening. Crossing the Wular Lake during the night we reached Bandipur the next morning. No boatman will cross this lake during the day if he can avoid it, for sudden storms and squalls are frequent, and the flat-bottomed, top-hampered houseboats fall easy victims.

At Bandipur I paid off the "doonga," and at the same time discovered that the Kashmir boatman is the exact prototype of that well-known product of civilisation—the cabby; for the look of assumed disgust on the face of the boatman, and his enquiry as to "what this was for," would have done credit to Arthur Roberts. Ponies for transport were soon obtained, and we left Bandipur by the Astor and Gilgit road for the Tragbal Pass, and spent the night in the wooden hut just below the summit of the pass. Next day we did a double march of 22 miles to Krishnagunga, as my "shikari" was anxious to secure a particular nullah there. This was rather a trying experience to a man fresh from a long hot weather in the plains, and the unaccustomed footgear added to my discomfort. The Kashmiri footgear consists of a bifurcated, coarse, woollen sock, having a stall for the big-toe, then a similar shaped sock of "puttoo" cloth, lacing up the front, and lastly, a plaited grass sandal, made, as required, by your "shikari," with a twisted cord of grass running between the big and second toes. After one has

become accustomed to these grass sandals there is nothing to touch them for comfort, lightness and security over every kind of ground, but at first I am doubtful if a pair of tight patent leathers would give as much trouble to a Kashmiri as these grass sandals do to the white man. I discovered during and after this march what excellent *masseurs* my two "shikaris" were. They kept me going all day, and charmed away all signs of the long march, except the blisters. Next day we did a short march up the nullah to Baghdori, a small village on the Krishnagunga River. After a rest of two days we explored the Baghdori nullahs thoroughly, but saw nothing, and as signs of animals were neither fresh nor plentiful we decided to move on another 8 miles to Gugai nullah, which we explored on the 20th, but saw nothing, so on the 22nd, taking a small *tente d'abri* and food for three days, we left the main camp and struck off up a smaller nullah to the north-east, called Dudghai, where bear were reported to have been seen by the villagers. Next day we started off early to the top of the nullah and in the afternoon I saw my first red bear, a fine old male, feeding among some wild pear trees about 600 yards below us. After watching him for some time in hopes that he would work in our direction, it was decided to try and stalk him, although the chances were very much against success, as the bear was feeding in thick jungle and the hillsides all around were covered with high withered grass and ferns, which crackled and rustled at the slightest touch; so much so, that the "shikari" likened our progress down the hill to that of "a herd of elephants." A bear's vision is not very acute, but his hearing and smell are extremely so, and this bear must have heard us in the grass, for he slipped away through the dense undergrowth and we could never come up with him again.

The next day, the 23rd, we started off before daybreak, and had a long day exploring the various branching nullahs, but without success. As we were making our way campwards, about 5 p.m., the "shikari" suddenly spotted a bear far above us, feeding among some wild "nashpati" trees, across a precipitous ravine. With the glass I could just make him out as he stood up to strip the fruit off the upper branches. We debated whether there would be time to reach the spot before dark, or if it would be better to leave him till to-morrow. I was all for instant action, but the "shikari" said it meant a long detour, on account of the wind, and a stiff climb, which he reckoned would take over an hour to do. I measured the distance and asked if he did not think he could manage it in less than that. He smiled, and said, "Oh, yes,

'sahib'; it's only half an hour's climb for us, but I said an hour because of you, 'sahib.'" That was enough, and we went down the side of that ravine in record time, but when I looked up the precipice we had to climb I felt inclined to agree with the "shikari," and I am sure I was in entire accord with him before we reached the top. About half-way up we had to zig-zag across a spur of shaley, blue clay, as slippery as glass, before we could reach a rib of rock, up which the climbing was easier. As I clung desperately to this, while the "shikari" cut little footholds for me, I was certainly not half so comfortable as the proverbial tom-tit on bird-lime, for he had no difficulty in sticking on, and I *had*, a lot. The prospect of a slip was not improved by the thought that, after a rapid slide of 100 yards, without a blade of grass to hold on to, there would be a nice little drop of 150 feet on to the rocks below. At last I reached the top, breathless and shaking, to find that there were several bears and a year-old cub, which could be seen climbing up the pear-trees. The same difficulty in stalking, or getting within reasonable distance, had to be overcome, and as we worked our way carefully round, above and to leeward of the bears, it was impossible to avoid the high withered ferns and grass, which grew everywhere round the bears' feeding ground. Creeping cautiously over the crest of a small hillock I reconnoitred the ground, but not a bear was to be seen. Thinking they had probably gone further into the belt of pear-trees, I began to crawl slowly through the grass, when suddenly the "shikari" clutched my arm and pointed to the side of the hill above us, and there were three bears, two large ones and a cub, sitting on the hillside in the grass, and gazing steadily in our direction. I was not ready for the shot, as I had not recovered from the effects of the stiff climb in such high altitudes, and the bears were in an awkward position, so I missed and they went down the hill to our left; but my second shot caught the big one squarely just as he was going over the edge of the ravine. It was too far back, however, to stop him, and they all got down the ravine under cover of the gathering darkness. We could find no blood tracks, but that was only to be expected, as I had hit him with a Mannlicher bullet, which makes little external wound, and the bear has such a coating of fat and such long hair at this time of year that external hæmorrhage is rare. On the following day I sent out coolies to look for traces of him, and in the meantime we went off to explore the highest branches of the nullah, but we saw nothing, except a small "bara-singh" stag, much too small to shoot. On returning to the camp, which had

moved after us up the nullah, we found the camp coolies full of their adventure of the morning. It appeared that they packed up the camp and followed about two hours after we had left, and close to the narrow pathway along the bottom of the nullah they had suddenly encountered two red bears, one evidently badly wounded. The bears resented being disturbed, and as they were evidently in an ugly mood, the coolies fled and sent a man to try and find us, which he had been unable to do. We immediately started off along the path, hoping to find the bear before dark. When we reached the spot where he had been seen in the morning we made a careful search, but without success, so I decided to try

a little further down and beat the grass on the side of the nullah. One "shikari" had preceded me about ten yards along the path when I caught sight of a brown mass a few yards from the path to my left, in the long grass. He was badly wounded, but none the less determined, and I had just time to get up my rifle and roll him over with a ·500 express bullet, within a few feet of where I stood. The other bear had evidently decamped, as nothing was seen of him. Finding this bear was a great stroke of luck, as he might easily have gone away and died and never been heard of. He was a fine bear, over 6 feet long, and his coat was in excellent

condition. We had the skin off in a very short time and came back to camp in the dark, cold but happy, after giving extensive orders for sheep and rice, so that the camp might celebrate the occasion with feast and song in an appropriate manner.

The weather up to now had been perfect, but on this day we had our first fall of snow, much to the "shikari's" delight, as it greatly increased our prospects of sport. That night, after dinner, sitting before a huge log fire, he entertained me with many strange and wonderful stories of "shikar," or escapes, accidents and sudden death, and graphic pictures of the various "sahibs" with whom he had served: the mad American collector, who "spoke in his nose," never wore a hat or any covering on his legs, who ate chicken, bones and all, and shot every living creature he saw, telling the "shikari" he intended getting 14,000 specimens and then set up a museum; of "Tumble 'sahib,'" with his ten guns and fourteen dogs; stories full of humorous detail.

The Kashmir "shikaris" are both good and bad—I have had both—and a real good one would be hard to beat. He is a wonderful tracker, and knows the habits and customs of his quarry in an extraordinary way. I had one man who would have made Sherlock Holmes turn green with envy. He could not, perhaps, tell much from a cigar ash, but he was an expert in "līd," or droppings. Most people are content to tell a pony's age from his teeth, but he could tell it from the fresh manure, and along with its age he could tell you who owned it, and from what village it came; while from a brown mass, for all the world like a plum cake, he could tell you what sort of bear had been feeding there, his age, height, weight and chest measurement, what nullah he came from and what nullah he was going to! I was always looking out for a chance to prove or disprove his deductions, but at last, when the chance came, they turned out to be perfectly correct!

On the following day we returned to the main camp, from which we had been away six days, and thence back to Baghdori, searching the nullahs on the way, without success. At Baghdori we got "khubber" of a very big red bear, which had for many years defeated every hunter. The villagers say he is "a child of the devil," and he certainly is possessed of supernatural cunning or an extremely well-organised Intelligence Department. He always disappears as soon as a "sahib" comes to the nullah to look for him, feeding only at night, and directly the "sahib" leaves he appears on some frequented path and kills a pony in broad daylight, just to show his independence. For six days we searched in

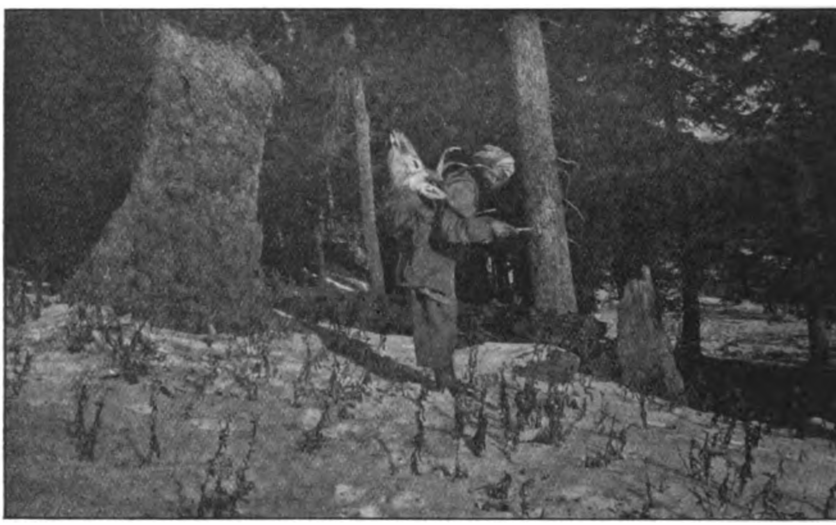
vain, and on the seventh day we thought we had him. We just caught a glimpse of a bear away across the nullah as he disappeared in the thick jungle at the bottom, coming our way, so we climbed down to meet him, and were greatly disappointed when we discovered he was a black bear. What he was doing there, in red bear country, only he could explain. With the help of a convenient hillock I got within 100 yards of him, and rolled him over with ·500 bullet. He had a fine coat, and although not what I wanted, still he was some slight reward for our trouble. I spent another week looking for the old one, and sat over a pony for twenty-four hours which had been killed and partially eaten by a bear, but he evidently did not care for the flavour, as he did not return for a second helping.

A month of my leave being now up, we had to leave the bear and retrace my steps to Tragbal. From Tragbal I dropped down into the Bouar nullah, where I intended to try for a "barasingh." This is a big nullah running north from Bandipur, and in the line of march of the stags as they pass from east to west on their annual pilgrimage. As the jungle was very thick and no snow as yet had fallen on the hill-tops to drive them down, I determined to have a "honk," or drive, for black bear, and then take my camp up to the open spaces and grass maidans above the jungle. The "gujar-lōg," or herdsmen, came to me when I arrived, and besought me to rid them of a most enterprising bear, which they said made a practice of coming down when darkness fell and eating their maize that they were just threshing. He refused to be driven off, came into the enclosures and had demolished "maunds" of corn-cobs. So I organised a "honk," as there was not enough moon to make certain of him at night. After he had come down from his rocky retreat at the head of the nullah and was known to be in the maize fields, the nullah above him was blocked by half a dozen coolies. He discovered this on making his way back in the early morning, so proceeded to make himself comfortable in the thick jungle lower down the nullah. Then, at dawn, the "shikari" and I took up our position at a convenient rock on the side of the nullah, commanding the pathway, and the beaters, armed with "tom-toms," horns, tin-cans and sticks, started up the nullah from below. As the sound of the beaters gradually drew nearer our excitement increased, then slowly cooled again as time went on and nothing appeared. Suddenly a tremendous hubbub, yells and shouts, mingling with the other noises, told us that something had happened. Then a shot rang out from the side of

the nullah. "That's the 'chota shikari,'" I said; "I wonder what the mischief he is doing there." I learned afterwards that the bear evidently did not care to face the nullah, suspecting something, so he made off up the side of the nullah, intending to get into the next nullah, but the "chota shikari," who had an old gun, had cunningly anticipated this move, and had placed stops on both sides to head him back. Suddenly the "shikari," who was standing up endeavouring to find out what had happened, crouched down and whispered, "He is coming, 'sahib'—up the path—a very big fellow," and I caught sight of a black object in the bushes, about 100 yards down the pathway. I had fixed upon a spot in the path, 40 yards away, where he would be in full view for 6 or 8 yards, as the best place, and I knelt with my eyes glued on the furthest edge of this open space. "Here he comes on the path," whispered the "shikari." I had a brief vision, over the rifle barrel, of a black head and shoulders, a great red tongue hanging out, and then of a shambling black body. I hit him in the shoulder; the ·500 bullet raked his whole chest, and he fell without a sound. The entire village turned out to escort us back to camp, and celebrated the event in the usual manner—by over-eating themselves.

Next day I left for the high ground, and after a long and toilsome climb of eight hours, got into camp in a snowstorm. near some empty herdsmen's huts, one of which I was glad to occupy for the night, so bitter was the cold. My camp was in a little hollow just below the crest of the hill, and within easy distance of the best feeding grounds around. Snow fell on the first day, but for a whole week there was none, and I was out late and early, searching the hill-tops and ravines, and watching the feeding grounds, but, except for a few small stags, not big enough to shoot, and plenty of females, I had no luck. On the 18th heavy clouds gathered, and shortly after starting out from camp in the afternoon a snowstorm came on. We tried several places, but drew blank, and decided to give it up for that day, as the storm showed no signs of abating. Coming home through the pine-woods, about 5 p.m., from a huge boulder in a little ravine we were crossing, there suddenly appeared a hind. We dropped at once, but she was very suspicious and remained looking in our direction and barking warningly for about five minutes. We carefully reconnoitred the ground, and, as nothing else was to be seen, except one small fawn, we concluded they were alone, and got up. Even then she was in no hurry to depart, and it was only when I threw a snowball at her that she made off. Imagine my feelings

when five or six hinds dashed out from behind the boulder, where they had been lying down, and after them a good stag. My rifle I had given back to the "shikari," and by the time I got it the stag was in the thickest of the jungle, and my snapshot missed him. It was a warning not to be too ready to jump to conclusions, for even my "shikari" had been deceived. Later in the day we had occasion to put the lesson to practical account, for as we trudged across the open glade in front of our camp, through the blinding snowstorm, I spotted a "bara-singh" sheltering behind a big rock in the dried up river-bed. It was a female, and the only



animal visible, but we were cautious, and thanks to the snowstorm were able to get close up and discover a herd of ten below the rock. Unfortunately, this time there was no stag, so we returned to camp empty handed.

The following afternoon, as the snow had ceased, I decided to visit a ground about 5 miles from camp, where I had seen a large herd of females on several occasions. Sure enough, we found a herd of eight or ten females and some youngsters, and, to my delight, with the glasses I made out a good stag among some boulders about 800 yards away. The place was a regular shallow amphitheatre, surrounded by bare snow-covered hills, except on one side, where the pine trees reached half-way down to the level.

Luckily, the wind was favourable, so we worked round to this side, and down the hill in the deep, soft snow among the trees, until we reached the edge of the clearing. We were now about 250 yards from the stag, and after waiting some time in hopes that the herd would feed towards us I decided to have a shot, when suddenly another stag "called" in the forest to our right, and bellowed defiance to all and sundry. Immediately the first stag saw him he answered the challenge and trotted out across the open to meet the newcomer, with his proud head held high, and all his herd gathered on the slope behind to watch the battle. For a moment the two stags stood eyeing one another, pawing the snow, and bellowing, then simultaneously lowered their heads and charged, meeting with a crash like that of a falling tree. It was a royal fight, and as I watched its varying fortunes from my seat in the circle, I became so absorbed that I quite forgot the rifle in my hand until the "shikari" had nudged me several times and besought me to "maro." Backwards and forwards they charged and struggled over the snow, until I saw that the intruder, who was the smaller of the two, was gradually being driven backward towards the forest, so I rested my rifle on the fallen tree-trunk from behind which I had watched the fight, and dropped the big stag with a bullet behind the shoulder. The other stag took no notice of the shot, but drew back and looked at his prostrate foe, then, either deciding that this was some new trick, or else to show his contempt for the enemy he had so easily vanquished, lowered his head and charged again and again at the dead stag. A bullet, which wounded him slightly in the foot, brought him to his senses, and he was off into the pine-wood, followed by his faithful hind, who had stood by in silent admiration during the fight. We cut off the head and brought it back to camp, sending out the coolies for the skin and the meat, of which they are extremely fond. The stag was an eight-pointer, the antlers measuring 35 inches.

Next day, as my licence had expired, I sent for coolies, and leaving the snows and big game, dropped down to the Kashmir Valley and spent the remainder of my two months shooting chakor and wild-duck round the Wular Lake, getting back to India on December 12th, after a most delightful holiday.

SNIPE SHOOTING AT MANDALAY.

By Lieutenant-Colonel W. WATSON PIKE, D.S.O.
Royal Army Medical Corps.

While stationed at Mandalay in 1905 I had the opportunity of getting some very fair snipe shooting, and a few notes may be of interest to my brother officers, and of some assistance to those who may be stationed there in future, as the local sportsmen keep their pet places very dark, and one has to find the places for one's self.

Snipe begin to appear round Mandalay about the end of September, but they are not really properly in till the middle of November. From this time till about the end of February fair bags of from twenty to fifty couple can be made within half an hours' drive of barracks.

I have found the following the best shooting kit (with, of course, a great coat and a rug for the drive there and back): A large and thick pith-topee, which can be bought at Port Said for a few shillings; Norfolk jacket made of "shikar" cloth, which can be obtained locally, and the pockets should be lined with waterproof cloth, as the dew on the long grass will wet the cartridges in the early morning; thin flannel shirt or vest, short sleeves preferred; loose cotton trousers reaching to the bulge of the calf and hanging over the tops of the gaiters (can be got locally for about 1 rupee 8 annas), fastened with a belt; light shooting boots with nails, and ordinary leather gaiters put on the bare legs.

For shooting through the heat of the day a spine-pad should be worn. I have found the best is a piece of cork matting, 24 inches by 8 inches (made of chopped cork); tie a bootlace to the upper corners, bring down in front and, after tying together, loop over belt buckle; the lower end should not be fastened to the waist, as it is far cooler so, and a great improvement on the spine-pads of cotton sewn or fastened on to the coat. The coat, of course, can be left off during the heat of the day, but this means that a small pouch to hold twenty to thirty cartridges must be worn. The "boys" should each have 100 to 150 in a bag, and the pouch or pocket can be constantly replenished. As regards cartridges, I prefer No. 9 shot, 1 ounce, with either Schultz E.C., or Diamond smokeless powder. They can be obtained (carriage paid on 1,000 and upwards) from Orr and Sons, of Rangoon, at 9 rupees 8 annas per 100, and, of course, cheaper from home. I would recommend any one coming out to bring at least 3,000, which he can easily dispose of if he cannot use them himself; they will keep, with care, for eighteen months.

One can shoot for the whole or for half a day, and I much prefer the latter, starting at, say, 10.30, and shooting from 11 to 3.30, and then back to a bath, afternoon tea and tennis, or a row on the moat before dinner. An ordinary shot will be generally able to pick up from twenty to thirty couple in this time, with a few quail or golden plover, and perhaps a duck or teal. This I call a pleasant day; but the "whole day shoot" requires a lot of hard labour, and tells heavily on those of us who have attained "exalted rank" and perhaps a wee bit of a "corporation." As regards drink, cold tea without milk and sugar suits me best. Each gun should have two beaters, one on either side, who carry 100 cartridges or so to begin with, and a snipe stick which should hold at least twenty couple. The beaters expect 8 annas each, and I generally used to pay more for bags over fifty couple, as it is an inducement to them to mark the birds carefully when they fall. The best bag for two guns I had was 123 couple, but I shot disgracefully that day, my partner killing seventy-four couple to my forty-nine. I shall be very glad to send a list of the half and whole day shoots round Mandalay to any of my brother officers stationed there.

Echoes from the Past.

"THE MILITARY MEDLEY. CONTAINING THE MOST NECESSARY RULES AND DIRECTIONS FOR ATTAINING A COMPLETE KNOWLEDGE OF THE ART.

"By THOMAS SYMES, Esq.

"*Captain in the Queen's Royal Regiment of Foot*, 1768."

[Lieutenant-Colonel A. R. Aldridge, R.A.M.C., sends the following extracts from an old book with the above title in his possession. It will be noticed that in places the orthography and punctuation are quaint, but these, Colonel Aldridge informs us, are in the original, and are not mistakes in copying.—Ed.]

Regulations and Orders, very proper to be given by the Colonel of a Regiment of Foot, to be strictly observed by Officers, Non-commissioned Officers, and private Men, as Standing Orders.

A Captain of a company to have a watchful eye over the behaviour of his private men; that when a knot falls he may be able to recommend the deserving for it.

An Infirmary-board to sit the first Monday in every Month composed of three Captains, to examine into the state of the infirmary.

The Commanding-officer must be strict in putting in execution the Articles of War against swearing; the penalty for which is one shilling, beside further punishment for the second offence.

A place to be provided, free from damp, to be as dark and dismal as possible, where clean dry straw is to be put every week; which place is to be called A Black Hole, where soldiers for offences are to be sent.

The complement of necessaries to be furnished each soldier.

Three shirts, two white stocks or rollers, one black hair stock, one pair of brass clasps for ditto, three pair of white yarn stockings, two pair of shoes, one pair of white linen gaiters, one pair of black gaiters, one pair of black tops for ditto, one pair of linen drawers, one pair of red skirt breeches, one red cap, one cockade, one knap-sack, one haversack, one pair of shoe-buckles, one pair of garter buckles, and black leather garters, one oil bottle, one brush and picker, one worm, one turn-key, one hammer-cap, one stopper.

Form of a Regimental Court Martial.

* * * * * * * * * *

Sentence.—The court having duly considered the evidence for and against the prisoner, are of opinion that he is guilty of a breach of the . . . article of the . . . section of the Articles of War; and do sentence him to receive . . . lashes with a cat-and-nine-tails on his bare back. A. B., Capt. and President.

If the delinquent is to be drummed out of the regiment, it is proper to annex, That it is the further opinion of the court, that the prisoner G. H. is, and he is hereby adjudged, unfit to have the honour of being a soldier; and, therefore, do order, that he shall be drummed out of the regiment with a halter hung about his neck, and a label pinned on his breast and back, upon which is to be wrote in large characters, the crime for which he is brought to public infamy.

The regiment intire to have two field days a week, and to have the manœuvre often varied; which will improve and direct Officers, instead of tiring their patience with repititions of the manual exercise. The Officers to be in regimental frock suits, and boots, their hair queued, buff-coloured gloves, with sash, gorget, espantoon

or fusee, whichever is the appointment of the regiment; the Non-commissioned Officers and private men, to have their hair well platted, and tucked under their caps and hats, to be fully accoutred, and in black spatterdashes with black tops.

The Surgeon to keep a book, in which shall be entered, every man's name, with his distemper, specifying whether he be sent to the regimental or other infirmary, and the day when.

The Surgeon and his Mate to visit the infirmary every morning, and as often as occasion may require; and every Saturday to make a return of the sick, wherein he is to insert every man's name, company he belongs to, and his disorder.

The Surgeon to lay a state of the expenses of the infirmary, and all other matters relating to it, before the Infirmary Board, the first Monday in every month, for their inspection.

When the regiment is under arms for exercise, the Surgeon, or his Mate, is to sign a return of the sick and lame of each company, which is to be given in with the field return.

The Surgeon or his Mate to attend at all times, when the regiment is under arms, morning and evening roll calls; and to be present at all punishments, to judge whether the delinquent has received a sufficient number of lashes for that time, that no punishment may extend to life or limb.

No recruit to be dismissed his drill, till he is so expert with his fire-lock, as to load and fire fifteen times in three minutes and three quarters.

The Paymaster-serjeant of each company, to keep a wig by him, which will dress in the regimental form, lest any man should lose his hair by sickness.

Return of the sick, &c of.........company
morning 17

Lame in quarters, A. B. Sergeant..........................	1
Ditto in barracks, C. D. Corporal..........................	1
Sick in infirmary, E. F. drummer	1
Sick in hospital, G. H. fifer	1
Total	4

To
The Surgeon J. K. Corporal.

The Corporals always to have a brush on the parade, that the soldiers cloathes may be clean brushed.

The Non-Commissioned Officers and soldiers when they meet an Officer either of the army or navy, in his Majesty' service, shall stand still at the distance of five yards, till he passes them; at the same time pulling off their hats with the left hand, without bowing their bodies, and letting their left hands fall to the extent of the arm, to be careful of their carriage that they may not contract an un-soldier-like air.

All men are to retire to their barracks or quarters, whenever there is any mob, bull-beating, or foot-ball matches, on pain of being confined for disobedience of orders.

Recruiting instructions for A.B. of the . . . . Regiment of Foot, commanded by . . . the . . . Day of . . 17 . .

(1) You are to inlist no man who is not a Protestant and a native of Great Britain; if any Irishman, or foreigner, through mistake, should happen to be approved of, and, within three months after joining the regiment, shall be discovered to be so, he will be discharged at your loss.

(2) You must inlist no man under the size of five feet......without shoes, or who has not straight limbs, broad shoulders, a good face, and is every way well made. You must inlist no man who cannot wear his hair, who is thin, or who has the least defect in his knees.

Regulations and Orders for a Regimental Infirmary.

Every soldier when taken sick, must be sent to the infirmary; a portable chair to be in readiness, and to be kept at the main-guard, to carry the sick men, if they are very ill; if they are not very ill, a Corporal and two men must assist the sick men to the infirmary. The orderly Corporal must bring the pay with the sick men; and he is to take care that the patient has a cap and shirt, and to search him, that he may not bring into the infirmary, money, cards, dice, spirits, or tobacco. If the sick man's mess is put in, his mess-mates must allow him his proportion in money, for the remainder of the week. s. d. per week is to be the infirmary allowance. A serjeant or Corporal of the companies, who have any men in the regimental infirmary, are ordered to carry their linen every . . . . and . . . . on which last day they must bring their subsistence, and pay it to the Serjeant attending the infirmary. . Any soldier

when a patient in the infirmary, who does not submit to the rules of the house, and directions of the doctor, is to be sent to the black-hole for twenty four hours, as soon as his cure is perfected. The Serjeant attending the infirmary must keep an exact account of the pay of each ward, oversee it being paid out by the nurse, according to the doctor's directions, and close the account every half week, that any man who is discharged on . . . . may have his overplus divided when he is dismissed. Every man discharged the infirmary must be duty free for three days or more, at the discretion of the Surgeon. If any of the nurses husbands are taken ill, such nurses must be dismissed, or her pay discontinued till the recovery of her husband.

REGULATIONS OF DIET FOR THE INFIRMARY.

Day of the week	Meals	Full diet	Half diet
Sunday and Thursday	Breakfast, Dinner, Supper	A pint of water-gruel. Eight ounces of boiled beef. One pint of broth.	A pint of water-gruel. Four ounces of beef and a pint of broth. A pint of broth.
Tuesday and Saturday	Breakfast, Dinner, Supper,	A pint of water-gruel. Eight ounces of boiled mutton. A pint of broth.	A pint of water-gruel. Four ounces of mutton and a pint of broth. A pint of broth.
Monday	Breakfast, Dinner, Supper,	A pint of water-gruel. A pint of rice milk. Two ounces of cheese, or one of butter.	A pint of water-gruel. A pint of rice milk. A pint of water-gruel.
Wednesday	Breakfast, Dinner, Supper,	A pint of water-gruel. Twelve ounces of pudding. Two ounces of cheese, or one of butter.	A pint of water-gruel. Six ounces of pudding. A pint of water-gruel.
Friday	Breakfast, Dinner, Supper,	A pint of water-gruel. A pint of barley-gruel. Two ounces of cheese, or one of butter.	A pint of water-gruel. A pint of barley-gruel. A pint of water-gruel.

N.B.—The men on full diet have a pound of bread and a pint of small beer every day. The men on half diet have half a pound of bread and a pint of small beer every day.

Copied from Bland's Diciplinc.

The same spirit that brings us into the Army should make us apply ourselves to the military art, the common forms of which may be easily attained by a moderate application, as well as capacity; neither is it below any military man, let his birth be

ever so noble, to be knowing in the minute parts of the service. It will not cramp his genius, as some have been pleased to say, in order, as I suppose, to excuse their own ignorance; but rather aid and assist it in great and daring enterprises.

Our late Monarch, the glorious King William, whose military capacity was second to none, was perfectly knowing in the small as well as the grand detail of an army. In visiting the out-posts he would frequently condescend to place the centinels himself, and instruct the officers how to do it.

Instructions drawn up by the late Major general James Wolf, for the twentieth regiment of Foot, then lying at Canterbury, in case of the French landing in 1755.

A soldier that takes his musket off his shoulder, and pretends to begin the battle without orders, will be put to death that instant.

A soldier that quits his rank, or offers to fly, is to be instantly put to death by the Officer who commands the platoon, or by the Officer or Serjeant in rear of the platoon.

If a Non-commissioned Officer, or private man is missing after an action, and joins his company afterwards unhurt, he will be reputed a coward and fugitive, and will be tried for his life.

Scheme of an Ensign's constant expenses.

	By a day			By 52 weeks.		
Breakfast	0	0	6	9	2	0
Dinner	0	1	0	18	4	0
Wine and beer	0	0	6	9	2	0
Four shirts, 4 stocks, and 4 handkerchiefs a week ..	0	0	2	3	0	8
Four pair of stockings, and two night caps a week ..	0	0	1	1	10	4
Hair powder, pomatum, soap, blackball, pens, paper, ink, wax and wafers	0	0	2	3	0	8
Soldier to dress your hair, shave you &c	0	0	1	2	12	0
Total	0	2	6	46	11	8
Your subsistence				54	15	0
Balance				8	3	4
Yearly arrears				7	14	3
Total balance				15	17	7

In barracks there will be an additional expense for washing of bed-curtains, sheets, pillow-cases, and towels. From hence you see how necessary it is for you to be an economist, and what a small balance you have to support the character of an Officer; and that upon a supposition of the arrears being paid yearly.

I must also beg leave to remark, that the present pay of an Ensign was established near a century ago, and, at that time, was worth thrice its present value.

American Weekly Allowance of Provisions for one Person.

Seven pounds of bread or flour.
Seven pounds of beef or pork.
Half a pound of rice.
Three pounds of peas; and
Six ounces of butter.

Method of going and receiving the Rounds in a Garrison.

When the Town-major goes his rounds, he comes to the main-guard and demands a Serjeant and four men to escort him to the next guard; and one of the men is to carry a lanthorn. He may go first to which gate he pleases; whereas all the other rounds, except the Govenor's or Commandant's, are to go according to the method prescribed them. As soon as the centinel at the guard-room pieceives the round coming, he should give notice to the guard, that they may be ready to turn out. When the round comes within twenty paces of the guard, he is to challenge; and, when he is answered by the Serjeant who attends the Town-major's round, he is to say, "Stand round"; after which he is to call out immediately, "Serjeant, turn out your guard, Town-major's round." No round is to advance after the centinel has challenged and ordered them to stand. Upon the centinel's calling, the Serjeant is to turn out the guard immediately, with shouldered arms and the Officer to post himself at the head of it. After this he is to order the Serjeant, and four men to advance towards the round, and challenge. When the Serjeant of the guard comes within six paces of the Serjeant who escorted the round, he is to halt and challenge briskly: the Sergeant of the escort answering, "Town-major's round"; he replies, "Advance Serjeant with the parole"; and then orders his men to rest their firelocks. The Sergeant of the escort advancing alone, gives the Sergeant of the guard the parole in his ear; and while he is giving it the Sergeant of the guard holds the spear of his halbert to the breast of the latter. He then orders the Sergeant to return to his escort; and leaving the men he brought with him to keep the round from advancing, goes to his Officer and gives him the parole he received from the Sergeant. The Officer finding the parole to be right, orders his Sergeant to return to his men, and says "Advance Town-major's round—rest your firelocks"; upon which the Sergeant of the guard orders his men to wheel back from the center and make

a lane, through which the round is to pass. The escort remaining where they were, he goes up to the Officer and laying his mouth to his ear, gives him the parole, the Officer holding the spear of his espontoon at the Town-major's breast while he gives it.

An estimate of the Funeral expenses of a Soldier, as near as may be.

	s	*d*
To the parson	2	0
To the Sexton	1	0
To the Grave digger	1	0
For the pall..	1	0
For a coffin	7	0
Total ..	12	0

STATE OF BRITISH HALF-PAY.

	Horse		Dragn		Foot	
Colonel and Captains per day ..	13	6	13	0	12	0
Lt. Col and Captains per day ..	12	0	10	0	8	6
Major and Captains per day ..	11	6	8	0	7	6
Captain	7	0	5	6	5	0
Lieutenant	5	0	3	0	2	4
Cornet, Ensign & 2nd Lt Mar	4	6	2	6	1	10
Quarter-master	3	0	2	0	2	0
Adjutant	2	0	2	0	2	0
Surgeon	2	0	2	0	2	0
Chaplain	3	4	3	4	3	4

Physician Hosp.	Forces	10*s*
Apothecary	Forces	5
Dep. Commissar.	Forces	5

Widow's pensions

	Per annum
Colonel's	50*l*
Lieutenant Colonel's	40
Major's..	30
Captain's	26
Lieutenant's	20
Ensign, Cornet, Adjutant, Quarter-master Surgeon, Chaplain.	16

Form of a beating order.

G. R.

These are to authorise you, by beat of drum or otherwise, to raise so many volunteers in any county or part of our kingdom of Great Britain, as are or shall be wanting to recruit and fill up the respective companies of our . . . . regiment of foot, under your command, to the number allowed upon the full establishment.

The speech.

To all aspiring heroes bold, who have spirits above slavery and trade, and inclinations to become gentlemen, by bearing arms in

his Majesty's . . . . regiment, commanded by the magnanimous . . . . let them repair to the drumhead (tow row dow) where each gentleman volunteer shall be kindly and honourably entertained, and enter into present pay and good quarters: besides which, gentlemen, for your further and better encouragement you shall receive one guinea advance; a crown to drink His Majesty King George's health; and when you come to join your respective regiment, shall have new hats, caps, arms, cloaths, and accoutrements, and everything that is necessary and fitting to complete a gentleman soldier.

God save their Majesties, and success to their arms.

Huzza Huzza Huzza.

Calculation of Expenses which a Recruit must necessarily be at for the first year.

	l	*s*	*d*
Two shirts	0	10	0
Two white stocks or rollers	0	1	0
A black frock	0	0	6
A stock buckle, or pair of clasps	0	0	5
Two pair of stockings	0	4	0
One pair of strong shoes	0	4	8
One pair of white linen spatterdashes	0	2	3
Two pair of black spatterdashes	0	3	2
One pair of black tops	0	0	7
One pair of ticking drawers	0	2	2
One pair of leather garters	0	0	4
Proportion of watch coat about	0	1	0
A cocade	0	0	6
A knapsack and sling	0	2	6
A haversack	0	1	0
An oil bottle and oil for his arms	0	0	7
A brush and picker	0	0	2
A worm and screw-key	0	0	4
A hammer cap and stopper	0	0	3
Shoe and garter buckles	0	1	0
For shaving and hair powder	0	3	0
Washing and cooking	0	19	0
Combs for his hair	0	0	6
Unavoidable extraordinaries on the march	0	6	0
Deduction for the Surgeon	0	4	4
Total	3	9	3
Subsistence for 52 weeks	9	2	0
Total subsistence in all	5	12	9

Reviews.

Materia Medica and Therapeutics. By J. Mitchel Bruce, M.D. London: Cassell and Co., Limited.

This, the forty-seventh thousand issued, is a revised and enlarged edition of this well-known volume. Published first in 1884, it has been repeatedly revised and enlarged during the last twenty years.

The present edition has been brought up to the level of our latest knowledge, and more detail than was formerly given has been introduced respecting the chemical and pharmaceutical relations of the individual drugs, while an entirely new part has been added containing an account of the materia medica and therapeutics of the drugs in the Indian and Colonial addendum to the British Pharmacopœia. R. J. S. S.

The Science and Art of Prescribing. By Colbeck and Chaplin. Second edition, revised and enlarged. London: Henry Kimpton, 1906. Price 3s. 6d. net.

The object of this book has been to provide a short and reliable guide to the art of prescribing, especially from a clinical and practical point of view. This second edition also contains an appendix, showing the chief ingredients of the more important patent medicines.

A large number of prescriptions are given, arranged, for convenience, under the various systems of the body to which their action is believed to be directed, and under each disease a short indication of the general line of treatment is given.

The book has proved to be useful in practice, both as an assistance to the memory, and as helping the prescriber to keep out of a groove. It is certainly worth adding to one's library. R. J. S. S.

The British Journal of Tuberculosis. Vol. i., No. 1. January, 1907. Published Quarterly. Single copies, 1s. 6d.; annual subscription, 5s., post free. London: Baillière, Tindall and Cox.

The object of this journal is the study of tuberculosis in its sociological aspects as well as from the point of view of the physician. "Sociology now claims a right to tender evidence and deduce conclusions, and insists that such a malady as tuberculosis must be studied with due regard to human action in relation to natural, social and economic conditions of life. Not only is State action imperative for the protection of each country, but international co-operation is essential, if such comprehensive and scientifically-directed policy is to be adopted as shall make for the extermination of this bane of humanity."

This is exactly the relation that is gradually being recognised as obligatory for the solution of the problem of Army sanitation: that, in fact, the duty of disease prevention is not incumbent solely on the medical man, but is one which bears on every member of the com-

munity in his degree, and that every member should receive such instruction as may be necessary to enable him to take his share in the work.

Tuberculosis is probably the one disease in which it may prove comparatively easy to work up popular enthusiasm to such a degree that it shall stimulate legislation. It is widespread; it has a strongly pathetic side in real life; it has, moreover, a permanent place in literature, both biographical and romantic. It is, therefore, suitable for popular discussion.

But there are other diseases, probably as important economically, which do not lend themselves to popular treatment. Syphilis, for example, demands as radical treatment as tuberculosis: it is emphatically a disease which can be dealt with only by State action; even more than tuberculosis, its etiology is well known and its causation under control. Sentiment is unfortunately against State action in this matter: instead of State prevention of disease it has been known as the State regulation of vice, and does not now exist. But with an example of organised action for the suppression of one disease, it may be easier for future generations to apply similar methods to the elimination of other sources of economic loss.

Professor Clifford Allbutt and Sir Samuel Wilks contribute interesting articles, which show the gradual development of present methods of treatment, while, on the other hand, Dr. R. W. Philip points out the way in which further progress is likely to be made. Sir R. D. Powell, Dr. Byron Bramwell and Sir J. W. Moore deal with the "Care and Control of the Consumptive Poor" in England, Scotland and Ireland respectively; these deal with organisation and methods; while Sir Lauder Brunton writes an important article on "Tuberculosis and National Efficiency." Sir Herman Weber contributes a short but comprehensive and suggestive article on "Climate as a Factor in the Treatment of Tuberculosis"; Dr. F. Hare's article on the "Treatment of Hæmoptysis by Nitrite of Amyl" is dealt with elsewhere.

The number also includes information as to institutions for the tuberculous, health stations, and a number of reviews and notices of books, preparations and appliances.

The whole number is valuable and interesting, and the journal promises to be exceedingly useful to all physicians. R. J. S. S.

Manual of Aseptic Surgery. By Major E. A. R. Newman, M.D., I.M.S., late House-Surgeon, West London Hospital. Published by Messrs. Thacker, Spink and Co., Calcutta. Price Rs. 3.8.0.

This little book has been written with the idea of embodying in compact form information on the subject of asepsis and antisepsis, which is to be found scattered throughout larger manuals.

It is a work which is intended to be chiefly of use to those whose duties are mainly concerned with the treatment of the sick of native regiments, or of the civil population in India. The chapter on surgical bacteriology is very clearly written. The idea of using an unirritating, inhibitory, antiseptic dusting powder for wounds of the skin, in places like the groin or scrotum, before applying sterile dressings, seems to be a good one. The author makes out a strong case for the use of antiseptic lotions in which to keep instruments immersed during operations; but one would like to have seen stress laid on the importance of replacing instruments in

the tray when finished with. The custom of leaving such articles lying about on the towels which surround the operation area is a very common one. The chapters on theatre construction and preparation of articles for surgical use are very good. One is glad to see the Primus stove mentioned in connection with sterilisers. For economy and comfort it is vastly superior to the miserable spirit lamps which are generally used in small theatres, and which are usually out of order just at the time the steriliser is wanted to prepare a fresh instrument. The chapter on the preparation of the hands is well up-to-date, and the author's warning, that "all wounds, septic or aseptic, should be touched as little as possible by the bare hands," is well worth remembering. One is glad to see that turpentine is strongly recommended as a fat solvent in the preparation of the skin. The amount of dirt which can be removed by rubbing with a turpentine swab, after apparently thorough washing with soap and water, is astonishing. One cannot agree with the author as to the necessity for free irrigation of aseptic liver abscess cavities. They seem to do quite well under simple drainage. The same applies to aseptic empyemata. The antiseptic treatment of chronic abscesses can, from personal experience, be completely recommended, and is a great improvement on the older methods. The chapter on aseptic precautions in ophthalmic surgery is very well written. It is not generally realised that solutions of perchloride of mercury of 1 in 2,000, can be safely used in the disinfection of the conjunctival sac.

The great majority of our officers put in one or more tours of foreign service in India, and as there are many stations in that country in which great opportunities for surgical practice amongst the natives exist, this little work may be recommended to those who find it necessary (owing to limited funds at their disposal) to improvise operating theatres and furniture, or to undertake the preparation of dressings and ligatures or other articles for surgical use. F. J. W. PORTER.

MODERN SURGICAL TECHNIQUE. By C. Yelverton Pearson, M.D., M.Ch., F.R.C.S. London: John Bale, Sons and Danielsson, Ltd. Pp. 392, 2 plates and 111 illustrations. 10s. 6d. net.

This book is one that should be read by every surgeon who wants a clear account of the principles of aseptic surgery and the methods by which its ends may best be attained. It will be found particularly useful by those who may not have been able to follow the rapid development of surgical opinion and practice and wish to bring their ideas on the subject up to date. And the greater part of the book, with the exception of those sections that deal with the actual operation, may, with advantage, be studied by sisters and nurses doing duty in operating theatres or in surgical wards. Numerous references to, and quotations from, the writings of leading authorities are given, and the author gives the results of his own experience and researches.

In the preliminary section we are glad to find the necessity of a practical knowledge of bacteriology insisted on; some knowledge of bacteriological methods must be the foundation of aseptic surgery.

The various channels of infection are discussed and their comparative importance weighed. The danger of trusting to antiseptic lotions for sterilising anything is insisted on, and some much-needed blows are struck at the hard-dying fetish, "1 in 20 carbolic."

The section on prophylactic disinfection is the most valuable in the book. The difficult question of disinfection of the hands and of the patient's skin is fully dealt with, and the arguments for and against the use of gloves are well summarised.

The section on wound technique calls for little remark. Some of the methods of suture described seem needlessly complicated and are probably little used, unless by their inventors. Simple methods carefully and accurately used are far preferable.

In the last section the chapters on the preparation of the patient and on treatment after operations are very good. We have not found any mention of the use of adrenalin in the treatment of shock, or of the subcutaneous injection of solutions of glucose.

The whole book will well repay careful study and can be confidently recommended.

Notes on Local Anæsthesia in General Surgery. By J. W. Struthers, M.B., F.R.C.S.Ed. Edinburgh: Wm. Green and Sons. Pp. 136, 6 figures. 2s. 6d. net.

In this useful little book the present position of local anæsthesia is clearly set forth. The subject is one of great practical importance, particularly to those who may have to deal with surgical cases without skilled assistance, and it is one that as yet has not received the attention it deserves in this country. This book gives an excellent and thoroughly practical introduction to the subject, with references to the more important original work that has been done, and should be in the hands of every naval and military surgeon. The comparative merits of the various drugs employed are fully discussed, and the different methods of producing anæsthesia are well described, and are illustrated by a number of instructive cases, which bring out the practical points that must be attended to in order to ensure good results. The author does not appear to have employed the method of producing analgesia by intraspinal injections, though he gives a very good account of it. We believe that when this method becomes better known it will be found most useful in a great many cases.

We do not share the author's preference for cocaine, as eucaine is not only safer and equally effective, but has the very great practical advantage over cocaine in that it can be readily and certainly sterilised by boiling. And in the instructions given on p. 38 for preparing the solutions, it would be better to add the adrenalin after the solution has cooled to about the temperature of the body, not while it is almost at boiling point. The use of long, fine, blunt-pointed needles for infiltrating muscles and deep structures is not mentioned.

A word of warning to beginners may not be out of place. The successful employment of local anæsthesia depends on a thorough understanding of the principles of the method used, on a sound knowledge of the anatomy of the part to be anæsthetised, especially of its nerve supply, and on strict attention to a number of details of technique. It is not enough, as some seem to think, to arm one's self with a special pattern of syringe and a solution of a given formula. And we would strongly advise a beginner to acquire some little knowledge of and

confidence in the method, and some degree of expertness in the technique, by means of a series of minor operations, before attempting any of the more complex procedures, such as radical cure of hernia.

HEATH'S MANUAL OF MINOR SURGERY AND BANDAGING. Thirteenth Edition, revised by Bilton Pollard, F.R.C.S. London: J. and A. Churchill. Pp. xiv., 409; 198 illustrations. 6s. net.

A book that has held its own for forty-five years and has reached its thirteenth edition has but little need of either introduction or commendation. Many generations of students and house-surgeons have profited by the sound and practical advice given in this book, which is marked throughout by the strong common sense and great experience of its author. The work of revision has been carefully done, and the book is in most respects thoroughly up-to-date. We are surprised to find 1 in 40 carbolic lotion recommended as an aid in the disinfection of the hands. And we have looked in vain for any mention of the iodine method of preparing catgut, which is by far the best and simplest method at present in use. These, however, are but minor blemishes, and detract but little from the value of the work as a guide to the young surgeon.

WAR WITH DISEASE. By F. F. Maccabe, M.B., Medical Officer, South of Ireland Imperial Yeomanry. Second Edition. Baillière, Tindall and Cox, 1907. Price 1s. net.

The first edition of this little work was noticed in the Journal last year. The author has revised the four lectures of which it originally consisted, and has added two, of an elementary character, on ambulance work. The alterations that have been made are improvements; and the same success which attended the publication of the lectures, and that has speedily called for a new edition, will no doubt accompany the present issue.

APPLIED BACTERIOLOGY. By C. G. Moore and R. T. Hewlett. Third Edition. Baillière, Tindall and Cox, 1906. 12s. 6d. net.

In this, the third edition of Messrs. Pearmain and Moore's well-known work, the place of the late Mr. Pearmain has been taken by Professor Hewlett, and, as stated in the preface, the volume has been practically rewritten and brought up to date.

The claim on the title page that it forms "an elementary handbook for the use of students of Hygiene, Medical Officers of Health, and Analysts," is, on the whole, well substantiated, the descriptions of bacteriological technique and apparatus being clear and easy to follow. In the chapters devoted to the principal bacterial diseases a large amount of information is put before the reader in a simple and systematic manner, and this section should prove of great service to those for whom the book is intended. The chapter upon the methods by which disease is spread, immunity, sero-therapy, &c., is perhaps scarcely as satisfactory, but, in the present state of our knowledge of these subjects, it can have been no easy task to steer between the Scylla of excessive details and the Charybdis of over-condensation.

Although dated June, 1906, the volume would appear to have made

a somewhat tardy journey through the press, as the instances in which the work of the last two years is either unmentioned or briefly referred to in a footnote are more common than one would expect. For example, in speaking of syphilis, the authors give the place of honour to the bacillus of Lustgarten, while the *Spirochæta pallida* is dismissed in five lines.

The portion of the book devoted to protozoal diseases is particularly condensed, and little reference is made to the progress of recent years. Sleeping sickness and kala-azar together occupy less than a page, and in the case of yellow fever no work of later date than 1901 is alluded to.

The chapters on disinfection and on the bacteriological examination of water, milk, air, &c., are clear and comprehensive, and will probably prove of most service to the reader.

The illustrations in the text are not very numerous, but the volume concludes with a series of coloured plates, which give a good idea of the cultural characteristics of the commoner micro-organisms and their appearance as seen in stained films.

THE BACTERIOLOGICAL EXAMINATION OF WATER SUPPLIES. Savage. 6s. 6d. net.

This is an excellent little book, and gives in a very readable form just what the beginner in water bacteriology requires to know in order to form an opinion as to the purity of a water submitted for examination.

The fallacies underlying the quantitative examination are closely stated, and it is pointed out that many of the published results, lacking particulars as to reaction of medium, time of incubation, &c., are practically valueless for purposes of comparison. The most recent work on the bacteriology of excreta, sewage and soil is fully considered in its relation to the bacteriological examination of water. The characteristics of the *B. coli*, typhoid and streptococcus groups are carefully given, and the value of each test is discussed. The author then considers the contents of various waters with regard to *B. coli*, and states that "there is no evidence or observations which have ever shown that *B. coli* reasonably defined is present in any numbers in sources which have not been exposed to some form of fæcal contamination." This is the keynote of the modern bacteriological examination of water, and unless the truth of the statement is admitted there is little value in the process. What is to be considered as a typical *B. coli*, or rather as the author prefers to call it "excretal *B. coli*," is clearly laid down, and the necessity of a numerical estimation of this organism is insisted upon. The vexed question of the value of the so-called atypical members of the coli group, as indicators of pollution, is discussed with judgment, and the absence of evidence that these organisms are derived from the typical members is commented upon. The author admits "organisms which are only atypical in that they do not produce indol or fail to coagulate milk" as indicators of polution, and most bacteriologists of experience will agree that the presence of such bacteria in a small quantity of water is undoubted evidence of contamination.

The book is clearly written, and can be recommenced as a safe guide to a difficult subject. W. H. H.

Current Literature.

The Treatment of Hæmoptysis by Nitrite of Amyl.—Francis Hare, M.D., in the *British Journal of Tuberculosis*, vol. i., No. 1, January, 1907. Dr. W. E. Dixon, in a recent article, has shown that most of the drugs commonly used in this country for internal hæmorrhage are all worse than useless for hæmoptysis; he speaks favourably of calcium chloride, and concludes that morphia will probably do more good than any other drug. Dr. Hare points out that he omitted "any mention of the drug which, in the opinion of those who have used it, is by far the most powerful hæmostatic of all, namely, nitrite of amyl."

Nine cases treated by Dr. Hare have been published; cases published by other observers bring the total to "about sixty attacks of hæmorrhage in thirty-three patients. All the attacks were treated by nitrite of amyl, and in every instance, except one, the bleeding ceased, and became reduced to a mere staining of the sputa, immediately, that is, within a minute or so." As to recurrence, in five of Dr. Hare's cases there was no recurrence; in four there was recurrence, in one in about half an hour, in the three remaining cases recurrence was delayed for several or many hours, and was stopped by a fresh inhalation.

As to dosage, Dr. Hare mostly used 3 minim capsules—no single inhalation contained more than 5 minims. "Such dosage probably errs on the side of caution." Other observers have given 9 to 10 minims "without disquieting results"; but apparently the dose should vary between these limits in relation to the severity of the bleeding.

This method is in practical operation in at least two institutions in Australia, where patients who have had, or may be expected to have, hæmoptysis carry the drug about with them for instant use.

R. J. S. S.

Observations on the Results of Anti-typhoid Inoculations amongst the German Troops in South-west Africa.—(Communicated by the General-Officer Commanding the Troops.) Translated from the *Archiv. für Schiffs-und Tropen Hygiene*, vol. ix., December, 1905, p. 527.

In connection with the subject of experiments with anti-typhoid inoculations in the German Protected Territory in South-west Africa, some reports have already been published in the twenty-eighth number of the publications on the subject of Military Medicine, issued by the Medical Department of the Prussian War Office. The first reports on the course of the disease in cases of enteric fever occurring after inoculation have now appeared. They are compiled by Stabsarzt (Surgeon-Captain) Dr. Morgenroth in Windhuk.

The observations were made on 424 cases of enteric fever, by means of a special card system. Exactly 100 of these were persons who had previously undergone one to three inoculations according to the Pfeiffer-Kolle method. Of these, thirty had been inoculated once, fifty-two twice, and eighteen three times. No information is given regarding the period between inoculation and onset of the disease; but the maximum period cannot have been more than ten months. It is expressly stated that the majority of the cases, which were most severe, were amongst men who

contracted the disease shortly after inoculation. What part the "negative phase" played in this can only be determined by a larger series of exact observations. It seems as if it never extended over a longer period than three weeks. Amongst those who had been inoculated in the Protected Territory itself and who contracted the disease one to two weeks after inoculation, the course was very severe, and in one case the disease was fatal.

More important than these remarks on the "negative phase" are the results of a comparison between the clinical symptoms in the inoculated and in the uninoculated. Of the 324 uninoculated, 36, or 11·1 per cent., died; of the 100 inoculated, 4, or 4 per cent., died. Septic conditions supervened in the case of one of these four; and this case alone had been twice inoculated. The others had been inoculated only once.

A distribution of the cases according to the severity of the disease gives the following results:—

	Uninoculated.	Inoculated.
Severe cases	82, or 25·3 per cent. ..	10, or 10 per cent., of which 6 were inoculated once, 3 were inoculated twice, 1 was inoculated thrice.
Moderately severe cases ..	69, or 21·3 ,, ..	20, or 20 per cent., of which 3 were inoculated once, 13 were inoculated twice, 4 were inoculated thrice.
Mild cases	137, or 42·3 ,, ..	66, or 66 per cent., of which 18 were inoculated once, 35 were inoculated twice, 13 were inoculated thrice.

The complications during the course of the disease were:—

Uninoculated.	Inoculated.
Scurvy in 38 cases (11·7 per cent.)	In 5 cases (5 per cent.).
Respiratory complication in 24 cases (7·4 per cent.)	In 4 cases (4 per cent.).
Heart complications in 13 cases (4 per cent.) ..	*Nil.*
Thrombosis in 5 cases (1·5 per cent.)	*Nil.*
Intestinal hæmorrhage in 4 cases (1·2 per cent.) ..	In 1 case (1 per cent.).
Nephritis in 4 cases (1·2 per cent.)	*Nil.*
Slight maladies (malaria, &c.) in 25 cases (7·7 per cent.)	In 10 cases (10 per cent.).
Total complications in 113 cases (34·9 per cent.) ..	In 20 cases (20 per cent.).

Further, medical officers, who had opportunities of observing uninoculated and inoculated cases alongside one another, invariably formed the opinion that, in South-west Africa, there was also a number of slight complications amongst the uninoculated, but that generally amongst the inoculated the symptoms of the toxin effects of the disease were not prominent. The latter seldom suffered from headache, almost without exception the brain was clear, cardiac action was little affected, and malaise was slight. Otherwise the usual symptoms of the disease were present (enlargement of spleen, rose spots, and pea-soup stools). In comparison with the non-inoculated the duration of the fever was less in the inoculated; and the temperature-curve, which was otherwise typical of enteric, did not reach so high a point. Finally, it was unanimously agreed that relapses were seldom observed in the case of the inoculated.

But a conclusive decision as regards the results of anti-typhoid inoculations cannot yet be arrived at, and must await later publications in connection with the valuable material which is now being collected in South Africa. But one conclusion can already be drawn from the information received, namely, that those who have been inoculated against enteric fever, even although they may not acquire complete and lasting immunity against infection, have a decided advantage over the non-inoculated should they contract the disease; and this in proportion to the number of times they have been inoculated. The toxin effects are considerably diminished, the complications less frequent, relapses are far fewer, and the case-mortality is reduced to more than half, almost to one-third.

Special stress should certainly be laid on the fact that the inoculated must live for at least three weeks after the second inoculation in surroundings free from enteric fever; that is to say, that the second inoculation should take place before starting on the voyage to South-west Africa, so far as the conditions in the Protected Territory are concerned.

After such favourable results refusal to undergo anti-typhoid inoculation on principle can no longer be justified. Still more is it to be recommended in connection with military operations in a country, such as South-west Africa, where the carrying out of the measures which are elsewhere efficacious in preventing disease is faced with the greatest difficulties.

W. G. M.

Correspondence.

THE SOLDIER'S HEART, AND THE CIVILIAN'S.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—As Major F. Smith's interesting article on the above subject in the January issue of the Corps Journal, 1907, upholds our present military position and Army gymnastic training—well-recognised causes of soldier's heart—the brief notice of the causation of the rapid pulse in the civilians examined by Major Smith may not be uninteresting to the readers of our Journal.

Major Smith apparently takes no account of the fact that nearly all men who come before a recruiting medical officer "chuck a chest," an art into the mysteries of which they have been initiated by the recruiting sergeant prior to their—the recruits'—appearance before the doctor. Now, when it is borne in mind that the various mechanisms of the body work together in unison, it will be readily perceived that disorganisation of the respiratory mechanism, which is the inevitable consequence of holding the body in a more or less rigid, or unnatural, position disturbs the heart's action, for the adequate activity of the respiratory pump is essential to that organ's well-being, as it furthers not only the return of venous blood but also the pulmonary circulation. A normal chest

poise is essential for the due performance of the respiratory act. The more expanded the chest is held the nearer are the circumferential attachments of the diaphragm to the level of the central tendon, *i.e.*, the flatter is the diaphragm and the less is its inspiratory and expiratory power. It is worthy of note that when the back is flat and the spine is kept as extended as possible, the chest will naturally assume its proper position. It is perhaps needless to remark that proper or physiological breathing means neither more nor less than *silent, controlled, nasal respiration;* and as long as the breath is taken noiselessly through the nose it is immaterial whether the mechanism employed is that of the lower costal type or abdominal type. With no other types of respiration is it possible for inspiration and expiration to be complete, full and regular.

With regard to Major Smith's opinion that our Army gymnastic training is not harmful in any way, I can prove by spirometric tests that the gymnastic training in the Army makes chiefly for thoracic rigidity. It should be noted, however, that the Army system does not stand alone in this respect, for all illogical systems bring about the same result.

Le Pont,
Switzerland,
January 18th, 1907.

I am, &c.,
R. F. E. Austin,
Major, R.A.M.C.

THE PREVENTION OF MALARIA IN INDIAN CANTONMENTS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—The means of preventing malaria in India at present in use may be said to be all directed to the treatment of the breeding places of mosquitoes. The success of this method depends upon the absolute elimination of Anopheles. This result is so difficult to obtain that a really marked and constant diminution in the incidence of malaria has never been obtained, either in India or elsewhere, when this method alone has been depended upon. This method of preventing malaria has the disadvantage of being very expensive if carried out with thoroughness. On the other hand, the protection of the individual and the segregation of persons known to be affected with malaria is infinitely more efficacious, and very much cheaper.

When it is remembered that a forgotten flower-pot or a single pocket of rock may form the breeding place for sufficient Anopheles to infect a regiment, it will be obvious that the most elaborate anti-malarial measures will be liable to be rendered useless through an oversight so trivial that it will be almost impossible to guard against it. When thirty or more men sleep in one room, it is not surprising that infection takes place from one to another, and an enormous malarial incidence is the result. The comparatively small malarial incidence among officers brings us to the appalling conclusion that the modern barrack-room is one of the most dangerous places in which a man can be compelled to sleep.

The means by which the individual may be protected from the bites of mosquitoes, and hence from malaria, are the following; (1) The use of wire gauze doors and windows in barrack-rooms; (2) electric fans or "punkahs"; (3) the disinfection of barrack-rooms by sulphur; (4) the use of mosquito nets; (5) prophylactic doses of quinine.

The first method is comparatively expensive; owing to the fact that some Anopheles will be sure to gain access to the room, and that some men must be assumed to be already infected, the result is unlikely to be a large diminution of the disease. The same remarks apply to the second method. In one station in which electric "punkahs" have been in use, a considerable increase in the admission-rate for malaria has taken place. The third method has been tried in India on a small scale, but the expense makes it prohibitive. It is unlikely to produce much effect, unless combined with the use of wire gauze doors. It is unnecessary to dwell upon the merits of the fourth method. It must be admitted that its application is attended with some difficulties in the case of soldiers. One objection which is often raised is that the men would be unable to stand the heat. This objection can be overcome by using a low net under the existing "punkahs," and by sleeping out of doors under a net during the hot weather. Another common objection is that unless a net be used with care it is worse than useless. This objection probably applies to every sanitary contrivance. The British troops in Sierra Leone have been provided with mosquito-nets, so the difficulties do not appear to be so insurmountable as one might suppose from Indian experience. The fifth method has been attempted both in India and in Africa without markedly affecting the incidence of malaria. However, the duration and severity of the attacks are probably lessened by this method.

The importance of that branch of sanitation known as anti-malarial measures cannot be over-rated, but it is necessary to bear in mind that unless the individual be also protected, preferably by means of nets, extensive operations and the expenditure of vast sums of money may be rendered useless by trivial circumstances, the difficulty of obviating which is so difficult and uncertain as to amount almost to an impossibility.

I am, &c.,

Jhansi,
December 27th, 1906.

ALFRED J. HULL,
Captain, R.A.M.C.

FAILURE IN REVACCINATION

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—May I suggest the possibility of "Failure" in a certain number of revaccinations being due to chemical antiseptics used to clean the scarifier? I have seen this instrument lying in a basin of 1 in 20 carbolic acid before use, and as the virus is somewhat readily destroyed

by chemical disinfectants, it seems reasonable to expect that it may fail to act if applied by means of an instrument which has been lying in a strong antiseptic before use. The flame of a spirit lamp would appear a safer means of disinfection.

I am, &c.,
F. J. W. Porter,
Major, R.A.M.C.

February 4th, 1907.

PREVENTIVE MEDICINE IN THE ARMY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I have read, with much interest, Major Pearse's article on "Preventive Medicine in the Army," in the current number of the Journal of the Royal Army Medical Corps, December, 1906, and I cannot help thinking that while a great deal of what he says is perfectly true, yet, underlying the whole scheme, there is an entirely wrong principle which would certainly be subversive of all discipline, especially in cases where a special Sanitary Officer may chance to be of a hasty or tactless disposition.

Major Pearse seems to assume that Principal Medical Officers are incapable of appreciating the true value of any recommendations made by a special Sanitary Officer, and also to think that the latter has a better chance of having his views understood, and his wishes carried out, by a General Officer Commanding who (almost certainly) has never had the smallest amount of training in the science of "Preventive Medicine," than by a Principal Medical Officer who, on the other hand, has, at various stages of his service, been obliged to go through courses of instruction in that science, and therefore must be in a better position than the General to sift the good from the bad proposals made to him.

As Principal Medical Officers are selected officers of long service, it may be assumed that they are men of exceptional ability and common-sense and great experience—an assumption that does not necessarily apply to all special Sanitary Officers. Principal Medical Officers have, as a rule, infinitely more practical experience than most Sanitary Officers and are consequently better able to judge how more purely scientific recommendations can be carried out without interfering with the military duties of the troops, &c.

If it was the rule for the special Sanitary Officer to communicate directly with the General Officer Commanding, the latter would certainly (in 99 cases out of 100) refer to his Principal Medical Officer any recommendation made by the special Sanitary Officer, and say, "Do you consider this officer's recommendations sound; and am I to follow his advice in the matter?" and in the end he would undoubtedly follow the advice of his Principal Medical Officer.

The advice of a special Sanitary Officer is most valuable, but, in my

opinion, it ought to be given to the Principal Medical Officer, whose duty it should be to thoroughly sift the advice thus given and then make the necessary recommendations to the General Officer Commanding.

In the same way as a General Officer Commanding in the field receives advice from his several staff officers as to the proper method of attack to be adopted, and, after carefully considering all the advice he has received, forms his own opinion as to the right course to pursue, and has to assume all responsibility for his action, so it should be with a Principal Medical Officer—he should receive expert advice from his special Sanitary Officer. As I have said above, he is, from the nature of his training, better able (than the General) to understand and appreciate that advice and the technicalities involved; he should base his opinions as far as possible on the advice of his special Sanitary Officer, and then offer the General any recommendation he may consider necessary; in doing so he rightly takes upon himself all responsibility for the recommendation made.

To allow a special Sanitary Officer to become a free lance would, I am sure, be followed by disastrous results.

Yours &c.,

Bermuda,
December 28th, 1906.

SEBERT F. GREEN,
Major, R.A.M.C.

WANTED, AN EXPLANATION!

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—During Christmas week I went to stay with the Resident at Sarant Wadi—a native State not far from Goa, and about seventeen miles inland from the small seaport of Vingorla. The climate is tropical, vegetation luxuriant, rainfall 130 inches; there is any amount of water about, even in the dry season—tanks, wet "paddy," and the like—yet there are no mosquitoes and no malaria. The Residency is ideally situated in respect to mosquitoes, but none of the party used, or required, curtains, and my host assured me they were never wanted at any season of the year. This was confirmed by others, including the doctor of the hospital—a qualified Parsi. I hunted for larvæ, but failed to find any. To add to the mystery I was informed that sixteen miles away the villages were well nigh depopulated with malignant malaria, and that though such cases were brought to the hospital from time to time, no contagion resulted. I rooted about in the vague hope that I was on the threshold of some epoch-making discovery; for, if we could locate the cause, it might be applicable elsewhere; but, I confess, I am just as puzzled now as I was then.

Yours faithfully,

Bombay,
January 22nd, 1907.

R. H. FORMAN,
Colonel, R.A.M.C.

A LITTLE KNOWN TREATMENT FOR SUNSTROKE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—In confirmation of Surgeon-General R. H. Quill's letter (*vide* "Correspondence" in the Journal for January, 1907), may I be permitted to quote an extract from my notes of the late Professor Maclean's lectures at Netley in the previous year (1871) as follows? "Parkes suggests an enema of ice-cold water to reduce excessive heat of the skin." This, of course, in addition to other routine treatment of sunstroke, wet packing, douche, &c.

It does not seem out of place, even at this distance of time, for senior as well as junior officers to direct attention to a matter of such enduring clinical interest, and, as I know, practical use, "lest we forget."

I am, &c.,

J. M. Beamish,
Colonel, R.A.M.C. (R.).

56, *Cantwell Road,*
Shooter's Hill, S.E.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—With reference to Captain Foulds' article on the Treatment of Heat-stroke by Ice-water Enemata, it may be of interest to your readers to hear our experience of this method.

We have both spent a considerable time in the station in which Captain Foulds obtained most of his experience of the treatment, and a considerable number of cases of this disease have come under our notice. In our opinion, the results of treating the disease with ice enemata were the reverse of conducive to its general adoption. Nearly all the cases in which the enemata were given showed marked collapse after the administration. One case thus treated which came under our notice terminated fatally in a few days with symptoms of severe "dysentery," and *post-mortem* the rectum was found to be partly gangrenous, the pathology being probably identical with the gangrene following frostbite, and due to prolonged exposure of the mucous membrane to a very low temperature. For these reasons neither of us felt justified in adopting this form of treatment.

The cases cited by Captain Foulds with temperatures varying from 103° F. to 105° F. might conceivably not have been heat stroke, and if they were they must have been mild ones: more probably they were cases of malarial hyperpyrexia, as are many cases of so-called heat-stroke.

More than 30 per cent. of the cases of hyperpyrexia admitted in Jhansi during 1904-1906, reacted at once to the administration of quinine intramuscularly. On the other hand, several cases of hyperpyrexia with temperatures of 107° F. to 109° F. have come under our notice, and they

all yielded to the ordinary external methods of treatment. It seems, therefore, that iced enemata should only be used, if at all, as a last resource, and certainly we think their administration as a routine measure is unnecessary, and not at all free from grave risk.

We are, yours, &c.,

Jhansi, India, ALFRED J. HULL AND KEPPEL H. REED,
January 18th, 1907. *Captains, R.A.M.C.*

ENTERIC FEVER IN AMBALA, 1880-1905.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I know nothing of Ambala, except from the above mentioned article by Lieutenant-Colonel S. Glenn Allen[1], and from information obtained from the study of Army Medical Department Reports. The fact that enteric fever was practically absent in Ambala in 1905, and that this improvement continued in 1906, is a very important one. There seems to me, however, one very curious omission in Lieutenant-Colonel Allen's paper, viz., the fact that in 1905 (according to the Army Medical Report for that year), in addition to the other sanitary reforms, a new water supply from deep wells was piped to the barracks and various standing camps. Almost all text-books on hygiene and medicine give water as an important, if not the most important, cause of enteric fever. Many instances could be given of the fact that with a pure water supply in place of a suspicious one the death-rate has marvellously decreased. To give one instance: in the barracks at Calcutta the death-rate was decreased thirty years ago from 100 per 1,000 to 10 per 1,000 simply by providing a pure water supply, and ever since Calcutta has been singularly free from enteric fever compared to many stations in India. Lieutenant-Colonel Allen states that water was not considered a cause of enteric fever in Ambala, but the fact that great expense must have been incurred in providing a new supply in place of the old one, from which an organism resembling *B. typhosus* had once been separated, and which was admittedly at all times liable to contamination, shows that this could not have been the opinion of all. In any case, the fact that in 1905 Ambala had a new and pure water supply was, I think, worthy of mention for the benefit of the readers of this Journal who have not the time, interest or opportunity, to study old Army Medical Reports.

I am, &c.,

York, NORMAN FAICHNIE,
February 11th, 1907. *Major, R.A.M.C.*

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[1] JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, February, 1907, p. 123.

VOLUME VIII. APRIL, 1907. No. 4

Journal of the Royal Army Medical Corps.

Original Communications.

THE EFFECTS OF LARGE DRAINAGE WORKS ON THE PREVALENCE OF MALARIA.

BY LIEUTENANT-COLONEL F. P. NICHOLS.
Royal Army Medical Corps.

"What time the gray fly winds her sultry horn."—LYCIDAS.

TOWARDS the end of 1904, Major (now Lieutenant-Colonel) Hodder, R.E., published a pamphlet entitled, "The Destruction of Mosquitoes," being an account of the drainage and other works carried out with this object during 1902 and 1903 at St. Lucia, West Indies—a most excellent, instructive and comprehensive work, in which he gives in detail, with some excellent maps and illustrations, the various works, large and small—including drain-cutting, reclamation of swamps, pumping, concreting, clearing and burning jungle and mosquito-proofing—undertaken in that island during those years by the Royal Engineers, together with the cost of each item and an account of the difficulties met with and the ingenuity shown in overcoming them. In a review of this pamphlet, published in a contemporary, regret was expressed that the same officer on the spot had not collaborated in the paper and added some scientific report on the results. It happens that these officers had collaborated to the fullest extent, as the reviewer might have seen had he read either the preface or the epilogue, where Lieutenant-Colonel Hodder most generously thanks them for their constant help and assistance. It was not, however,

thought that sufficient time had then elapsed for any expression of opinion as to the effects of these works to be of real value, and our assistance was therefore limited to giving the author all the aid and advice in our power in the compilation of his work, and to editing those parts of the manuscript where our scientific knowledge was useful. Since that time more than two years have passed, and St. Lucia has been evacuated. I have been enabled, by the courtesy of the Director-General, Army Medical Service, to study the Annual Reports down to the time of the withdrawal of the troops; and this little paper is a humble attempt to draw an inference as to the results of the work described so ably in Lieutenant-Colonel Hodder's pamphlet.

The island of St. Lucia is manifestly designed for the comfort and reproduction of mosquitoes, and it is permitted to hope, though with less confidence, that the posting of troops there, the building of expensive barracks, and the subsequent withdrawal, was also the result of some less evident purpose, perhaps as a gigantic malarial experiment. The climate is moist, with an average rainfall of 100 inches, and there are not many rainless days in the year; it is also reasonably warm, the temperature ranging between 75° F. and 85° F., and the thermometer mostly standing at 80° F. The conformation of the land is a series of precipitous mountains and deep ravines closed with dense, almost impenetrable, jungle, which grows in rank luxuriance on the stiff clayey soil, resulting from the disintegration of the gneissic rock of which the island is geologically composed. Here the mosquito reigns supreme, and man —mere man—is but a condition of her existence; man, the seafarer, who has to live beside the element that feeds him; man, the trader, who has to inhabit the low-lying port; man, the sugar-planter, the cocoa-planter, the agriculturist, who must occupy the valleys for the purpose of his livelihood.

Nature marshals all her forces to favour insect life; each ravine is a series of sheltered, stagnant pools and hollowed stones, which retain the water of the last freshet till dried by the sun or replenished by a shower; the mouth of every streamlet blocked with *débris* washed down by the frequent torrential rains becomes a swamp; every indentation in the impervious soil holds water till it evaporates in a rare succession of sunny days. Here is no question of draining isolated puddles—the labour would be endless, a topsy-turvy Danaid task—or of oiling stagnant pools, except in the interest of the "Standard Oil Trust;" it is a problem of large works: the clearing and levelling of jungle, the drainage and

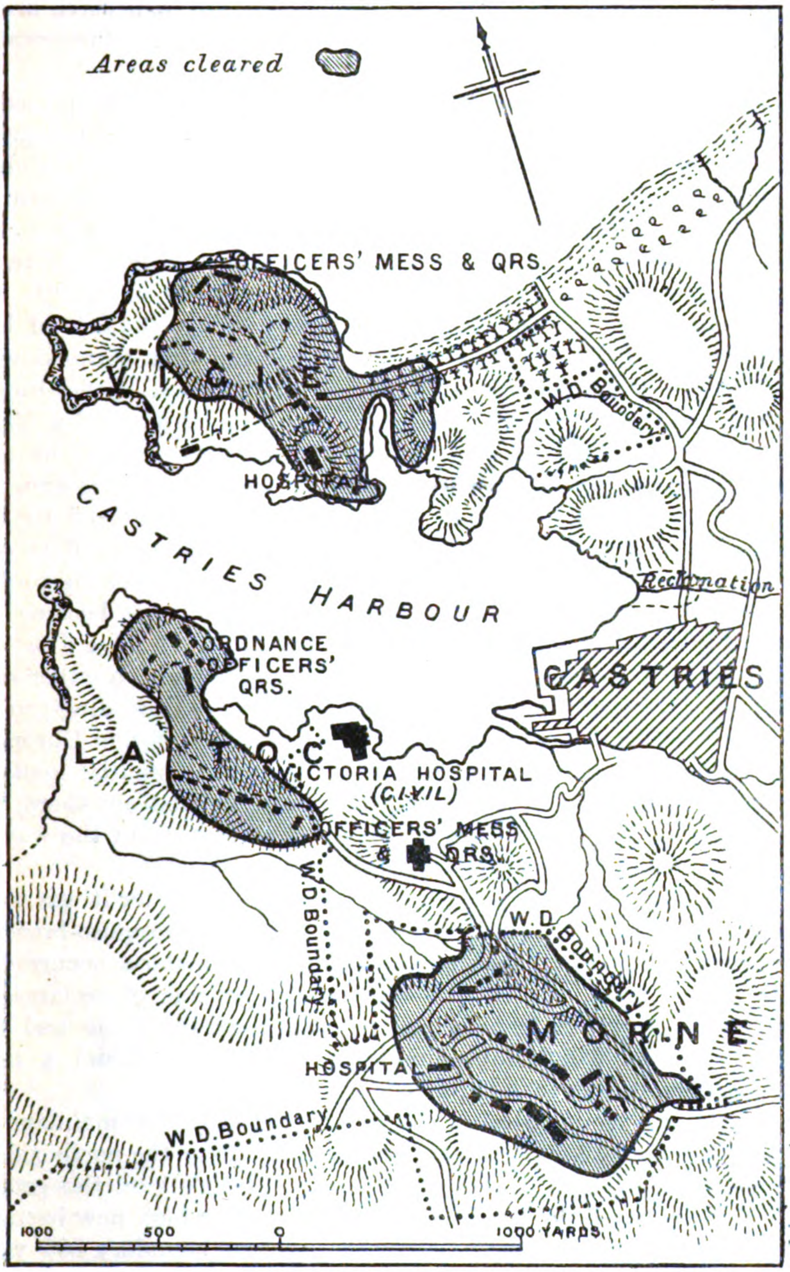

Areas cleared
OFFICERS' MESS & QRS.
VIGIE
W.D. Boundary
HOSPITAL
CASTRIES HARBOUR
Reclamation
ORDNANCE OFFICERS' QRS.
CASTRIES
LA TOC
VICTORIA HOSPITAL (CIVIL)
OFFICERS' MESS & QRS.
W.D. Boundary
W.D. Boundary
MORNE
HOSPITAL
W.D. Boundary
1000 500 0 1000 YARDS

Fig. 1.

pumping of low-lying swamps; the gentle but expensive art of guiding rainfall into cemented channels along the natural water-courses.

I must here call attention to the map (fig. 1) kindly placed at my disposal by the Royal Engineers' Institute, where Lieutenant-Colonel Hodder's pamphlet was published, in which are shown, though on a small scale, the situation of the barracks and the areas principally affected by the drainage and clearing works. Instinctive reasoning long before the knowledge of the association between mosquitoes and malaria—and also probably ideas of health and comfort—led to troops occupying, where possible, the tops of hills and windward sides of ridges. It will be seen that barracks were situated in three localities, on the Morne Fortuné, a flat-topped 800-feet hill; at La Toc, a ridge cresting a deep ravine, and at Vigie, a hill sloping up from a large expanse of swampy ground, the only flat surface in this part of the island. Of the Morne it is unnecessary to say much, for during most of the period covered by this paper it was practically uninhabited, at first on account of an outbreak of yellow fever, next because of a new and up-to-date sewerage system being installed, and later because it became the site of some very fine new barracks not occupied. La Toc is a knife edge of volcanic rock overlooking deep ravines on either side, that on the west being densely forested and a fine breeding ground for mosquitoes. It was occupied by a company of non-European Royal Garrison Artillery, who provided a very substantial quota of malarial cases. No very special works were carried out there, but it shared in the general improvement of sanitation in the way of jungle clearing, draining and cementing.

Vigie (fig. 2) merits a more detailed description, for it was there that the troops were most exposed to the peril of mosquito-breeding swamps, it was there that a great epidemic of malaria occurred in 1901-2, and there was carried out the big scheme of reclamation and drainage which transformed the aspect of the place and was followed by a wonderful diminution of mosquitoes and a most satisfactory drop in malarial fever.

Vigie is a steep volcanic rock connected with the mainland by a narrow neck of lowlying sand and swamp, along the north side of which has been built a road or causeway. In 1901 all the ground from the very foot of the hill, on the slopes of which new barracks had been lately built, to the War Department boundary 800 yards away, was continuous swamp, never thoroughly dry, squashy after moderate rain, a quagmire in which your horse sank to his hocks during the rainy season, from May to October or November.

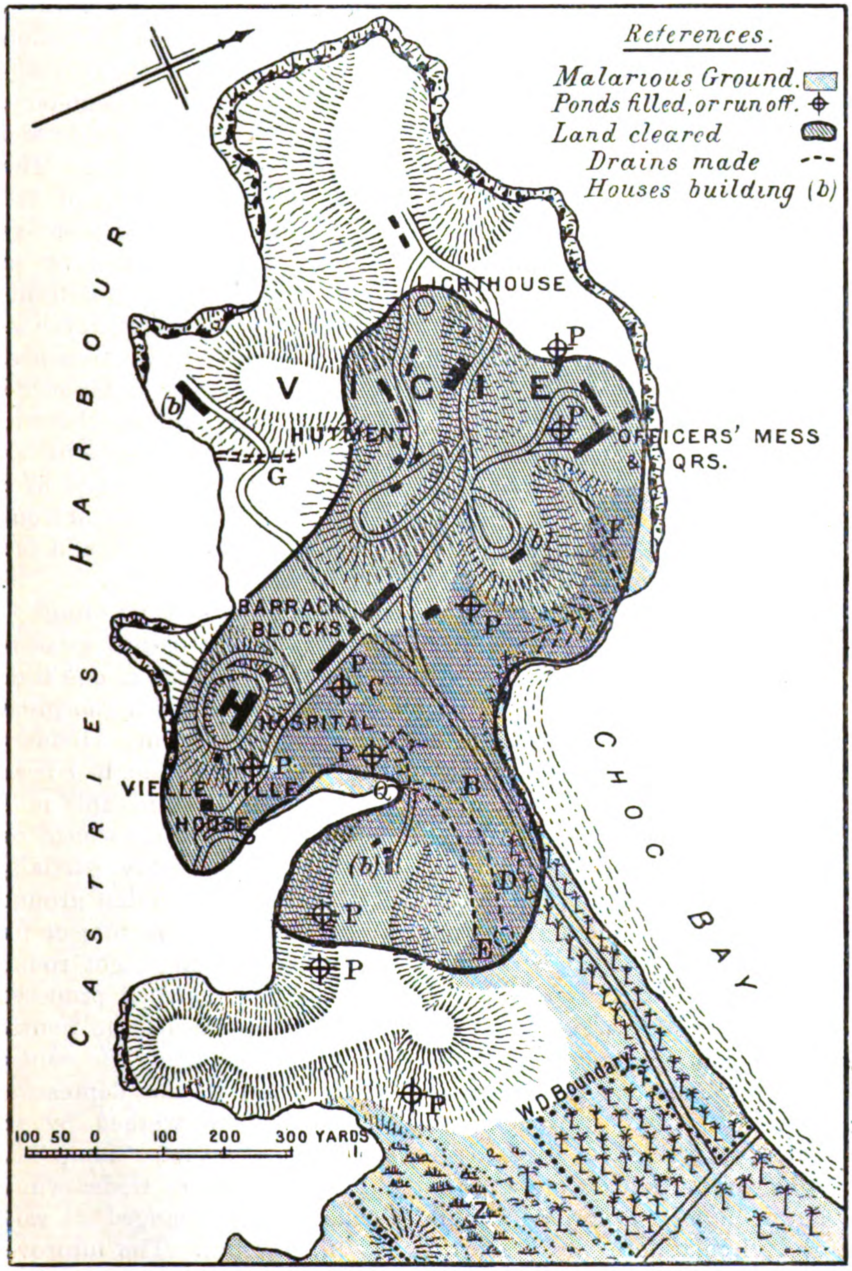

References.
Malarious Ground.
Ponds filled, or run off.
Land cleared
Drains made
Houses building (b)
CASTRIES HARBOUR
CHOC BAY
VIGIE
LIGHTHOUSE
HUTMENT
OFFICERS' MESS & QRS.
BARRACK BLOCKS
HOSPITAL
VIELLE VILLE HOUSE
W.D. Boundary
100 50 0 100 200 300 YARDS

FIG. 2.

For convenience of reference this lowlying ground was divided into the parade ground swamp (B)—for this was the normal function of part of it—and the cocoa-nut swamp (D). Another dreary quagmire lay beyond, running up to the War Department boundary, called the mangrove swamp (Z), but to attempt to reclaim this was beyond the dreams of our ambition—or the funds allotted. The first to receive attention was the parade ground swamp and the marshy land (C) sloping from it towards the hill at whose base lay the newly constructed barracks. What was done I give in Lieutenant-Colonel Hodder's own words: "Both filling and draining were resorted to. The drains, which were given as much fall as possible, consisted of trenches filled with stones; these trenches, being so near the sea-level, formed places where the water could collect rather than run off, and so percolate gradually into the sea. It would have been useless to place drain-pipes in the trenches as the ground was so soft that they would have become choked in a few years;" . . . . "the portions of ground (C) close in front of the barrack blocks were pitted with numerous holes and old ditches, which were all filled with water in wet weather" . . . . "the actual parade ground was raised and levelled by sand filling."

The next area to receive attention was the cocoa-nut swamp. This consisted of many acres of very low-lying ground, at one time under cane cultivation, and continuous to the south with the great mangrove swamp. Again I quote Lieutenant-Colonel Hodder: "A concrete catch-water surface channel, one yard wide, had been formed at the commencement of operations to prevent this land being flooded from the above-mentioned hill (a hill to the south, on which was built a Government quarter); as this only partially fulfilled its object and as the catch-area of the surrounding ground was very large, small improvement was manifest. A project for a deep concrete drain with dry rubble sides running right round from Vigie creek to the large mangrove swamp was then proposed and approved (E). There is a large depression in the centre of this line, and to get over the difficulty of gradient, the centre portion of the concrete drain was given a fall to this depression where a 'sump' was constructed and a pump worked by an air-motor erected." Perhaps I should explain that "sump" is Sapperese for a deep pit, and that in these regions of trades-winds the air-motor (a glorified windmill which has exchanged its sails for a circular fan) works merrily, day in, day out. The improvement that resulted in these swamps was simply astonishing. After heavy rain the drains could be seen running 10 or 12 inches deep,

and the swamp rapidly dried. When I first visited this morass in December, 1902, my horse sank to his hocks in the ill-smelling mud, and it remained in the same condition until the completion of the drainage works during the following year, shortly after which I constantly walked over it dry-shod. Where in 1902 I could find larvæ in every cupful of water, in 1903 I was able to find no water in which mosquitoes could breed. The whole character of the country was changed for a distance of 600 yards. Other works at Vigie consisted, as at Morne and La Toc, in concreting the bottoms of watercourses where pools formed in dry weather, letting off water from cattle-ponds, and filling up, cutting and clearing bush, concreting surface channels, and rendering water tanks mosquito-proof. The summaries given in Tables I., II. and III. show the works executed at Vigie, Morne Fortuné, and La Toc respectively, from December, 1901, to February, 1904, with the cost. One or two other points must be mentioned before leaving this part of my subject. During the building operations on the Morne, where much stone was required, use was made of the innumerable gneissic boulders left as "cores" after the disintegration of the softer parts of the rock. These were dug or blasted out of the clayey matrix, and the resulting holes made excellent breeding-grounds for mosquitoes. All these holes had to be filled up. At a less scientific period of St. Lucian history the surface gutters along the Morne roads had been broken by catch-pits to collect the silt brought down by heavy rain; more perfect breeding places for Anopheles could not have been designed, but considerable expense was involved in getting rid of them. A mere bald description such as this gives little idea of the thought, resource, and ingenuity devoted to carrying out these manifold works by the officers of the Royal Engineers. I think nothing quite like them has been accomplished before, as the conditions were very exceptional and many had to be begun tentatively, seeing they were really experimental. All through the officers, Royal Engineers and Royal Army Medical Corps, worked cordially together, and suggestions were frankly offered and adopted, or not, after full consultation.

Having given some account of the natural conditions of the island and of the means taken to modify them in favour of human occupation, I propose now giving some impressions (as they are not based on any scientific observations, I fear I can call them by no higher name) on the apparent effects of the foregoing works on the prevalence of mosquitoes and malaria. Early in 1902, on account of an outbreak of yellow fever at the Morne, the white troops (one

TABLE I.—SUMMARY OF WORKS EXECUTED AT VIGIE, FROM DECEMBER 1ST, 1901, TO FEBRUARY 29TH, 1904.

Item.	Area.	Nature of Work.
Low-lying swamp	3 acres ..	Filling with earth and sand; forming drains filled with stones.
Parade-ground	4 ,, ..	Filling with sand.
Slope east of barrack blocks	.. ..	Filling numerous small holes, levelling, clearing, &c.
Cocoa-nut swamp	7 acres ..	Deep artesian drain, with air-motor pump.
,, ,, ...	7 ,, ..	Catch-water surface channel.
Beds of two watercourses ..	1,200 ft. ..	Concreting bottom.
Eight large cattle-ponds ..	15 to 20 ft. diameter	Filling or running off.
Numerous small pools ..	.. ..	Filling up.
Surface channels	.. ..	Renewing and laying in various places.
About thirty water-tanks ..	Various sizes	Rendering roofs mosquito-proof.
Bush	75 acres ..	Cutting and burning.
Minor swamps	.. ..	Draining with agricultural pipes and stones.

COST OF ABOVE .. .. £1,935.

TABLE II.—SUMMARY OF WORKS EXECUTED AT MORNE FORTUNÉ, FROM DECEMBER 31ST, 1901, TO FEBRUARY 29TH, 1904.

Item.	Area.	Nature of Work.
Swamp near drill-shed ..	3 acres ..	Draining with agricultural and stone drains.
Holes on slopes of Morne ..	.. ..	Filling and running off water.
Surface channels and watercourses	.. ..	Concreting bottom.
Thick old bush	100 acres ..	Clearing and cutting trees.
Swamp near the mount ..	3 acres ..	Cutting open drains and clearing thick bush.
Concrete catch-pits	.. ..	Filling up to pipe level.
About 100 water-tanks ..	All sizes ..	Making covers mosquito-proof.
Watercourses	.. ..	Clearing and filling holes.

COST OF ABOVE .. .. £1,613.

TABLE III.—SUMMARY OF WORKS EXECUTED AT LA TOC, FROM DECEMBER 1ST, 1901, TO FEBRUARY 29TH, 1904.

Item.	Area.	Nature of Work.
Surface channels	.. ..	Concreting.
About twenty tanks ..	Various sizes	Making mosquito-proof.
Various holes and small swamps	.. ..	Filling and draining off.
Large trees and old bush ..	30 acres ..	Cutting, clearing, and burning.

COST OF ABOVE .. .. £302.

company Royal Garrison Artillery and one company infantry) were moved hastily into two new brick barrack blocks at Vigie, recently completed and furnished with every modern sanitary convenience. These blocks were built on the lower slopes of Vigie hill, to windward of the extensive swamps before mentioned, and in the vicinity of many waterholes, uncemented nullahs, &c., the breeding-ground of innumerable mosquitoes. Shortly afterwards, malarial fever broke out among them as an epidemic: two died, an enormous percentage were affected—117 cases among 229 men during January and February—and it was found necessary to remove them to Pigeon Island, a breezy, barren spot, some few hundred yards from the mainland, where they quickly recovered. Malaria was not epidemic among the non-European troops stationed on the top of Vigie hill or at La Toc, but was practically confined to this body of men. Major (now Lieutenant-Colonel) J. Will, R.A.M.C., in medical charge of the troops, attributed the outbreak to the swarms of mosquitoes in the new buildings, bred in the adjacent marshes and infected by the numerous native labourers employed by the Royal Engineers. As soon as the cause was recognised steps were taken to remove it, drainage, clearing, concreting, filling, protecting, fumigating, were at once begun and the larger schemes detailed above were shortly afterwards commenced. The apparent effects were very marked, as noted by both officers and men, by Major Bent, R.A.M.C. (to whom I am indebted for many notes on the point), and by the other Royal Army Medical Corps officers, and as testified by the immediate drop in the admission-rate for malarial fevers—*which began at once and has continued ever since.* Lieutenant-Colonel Hodder says: "At the present time (1904), in buildings which were formerly infested with mosquitoes of all kinds, scarcely a sign of one exists; but it has taken two years of continuous work to effect this result."

Major Bent, R.A.M.C., who had experience of the island both before and after the drainage operations were well in hand, was loud in his appreciation of the results. I may here add, in sweet harmony, my own pæan of praise. I arrived in December, 1902. The parade ground swamp at Vigie had been filled in and drained, the marshy ground between it and the new barracks had been levelled, cleared, and drained, tanks had been mosquito-proofed, and much cementing had been done both at Vigie and also at the Morne and La Toc. The new barracks at Vigie were occupied by West Indian troops. The admissions for malarial fevers were dropping rapidly. No troops were stationed on the Morne, but the

Military Hospital—an old building—was there and mosquitoes were fairly plentiful in it. At Vigie mosquitoes were comparatively rare except in the evenings, when they drifted in from the large swamps 300 yards away. The cocoa-nut swamp had not then been tackled, and I well remember my first introduction to it by Major Bent soon after my arrival—a noisome morass of many acres in which our ponies could not move, where every handful of water contained Anopheles larvæ; twelve months later this swamp at the same time of year was dry. In the new hospital at Vigie, which had meanwhile been opened, a mosquito was regarded as a *rara avis*, and even in the barracks, which had swarmed with them eighteen months previously, as an intruder.

At the risk of personal prosing let me give one detailed account of what I believe (although I cannot prove) to be an example of direct benefit due to draining and clearing. Soon after arriving at St. Lucia I dined with some friends inhabiting a Government quarter on the Morne, at the head of a deep ravine. During dinner such swarms of mosquitoes appeared that the windows had to be closed, and my host informed me that this was no uncommon proceeding, their lives being rendered miserable by these insects, which seemed to be blown by the evening wind into the house from the neighbouring bush. Next day I carefully examined the house and surroundings. I found that it was built on the leeward side of a deep narrow valley running from the Morne road to the sea, some 600 feet down and three-quarters of a mile away. The sides of the valley were densely covered with rough grass, boulders, bush-jungle and large trees, so thick as to make progress a very difficult matter. This jungle extended to within 30 yards of the house, which occupied a small clearing of a few square yards cut out of the forest. At the bottom of the valley was a watercourse filled with huge water-worn boulders—a trickling stream in dry weather, a rushing torrent in wet weather. Sixty yards from the head of this ravine, almost hidden in the dense jungle, I found a native hut and a well, surrounded by a morass of stinking mud. The well was used by washerwomen and was full of Anopheles larvæ, which were also to be found in abundance in the numerous puddles of the watercourse. After consultation with the Divisional Officer of the Royal Engineers, we determined to clear this pestiferous place. The well was closed, not without protest, an army of coolies with axes, machetes, spades, picks and dynamite, was let loose on the picturesque but unwholesome spot, and in three months' time the valley was cleared for 400 yards, cemented drains carried the rain-

fall down the slopes, boulders were blasted and removed, holes filled, jungle cut and burned, hundreds of large trees felled—a lovely valley was turned into a hideous eye-sore, and we were voted madmen and vandals. The effect in the Government quarter previously mentioned, and in other quarters in the vicinity, was magical, and made amends for the unpopularity we had incurred. Mosquitoes became interesting curiosities, *jalousies* could be kept open night and day, and though I frequently visited my friends again, I never dined with closed windows. This is but an instance of what was effected in many places; the same cause, clearing and draining, produced the same results—absence of mosquitoes and, of course, malaria—but it was expensive, the above little experiment costing over £200.

The following species of mosquitoes have been identified in St. Lucia, and probably the list is not by any means exhaustive: *Anopheles albipes* and *argyrotarsus; Stegomyia fasciata* and *tæniata ; Culex fatigans, tæniorrhyncus* and *nigripes; Uranotænia lowii ; Branchiosoma magna ; Deinocerites.*

Of these *S. fasciata* is by far the most abundant, but both varieties of Anopheles can readily be found in larval form in suitable climatic conditions. These conditions appear here, as elsewhere, to be mainly modified by the incidence of the rainfall. Heavy torrential rains, such as we frequently experienced during July, August and September, when 2, 3, or even 4 inches of rain would fall in twenty-four hours, washed the larvæ away; on the other hand, spells of dry weather, such as we sometimes, though seldom, enjoyed, dried up the puddles and the larvæ too. Intermittent showers, with sunny intervals, provided sufficient water for the laying of eggs and sufficient time for hatching them out, the clayey soil preventing the absorption of the water, and the luxuriant vegetation delaying its evaporation. One curious fact requires elucidation, viz., the abundance of Anopheles in St. Lucia and the entire absence of them in Barbados, only 80 miles distant, with frequent communication. Bermuda, I am told, enjoys a like immunity. Now both Barbados and Bermuda are coral formations, though of different geologic age, and their waters are necessarily impregnated with lime, while St. Lucia is purely volcanic and contains practically no lime salts in its water. A point noticed by both Lieutenant-Colonel Hodder and myself was that in the cement tanks used for building requirements, where water had every opportunity of dissolving lime, we never found Anopheles larvæ, but sometimes Culex larvæ, although both could be readily found in the immediate vicinity.

The history of malaria in St. Lucia during recent years is very interesting. I have thought it well to treat of it separately as affecting European and non-European, *i.e.*, black troops, both because the statistics present different features of interest and because the conditions of life are not quite the same in the two cases. I present first, in Table IV., statistics taken from official sources of the incidence of "malarial" fevers and of "simple continued" fevers on the European troops. It will be at once noticed how great are the variations in incidence in different years, also how on the whole a high incidence of malarial cases is associated with a low incidence of simple continued fever cases, and *vice versâ*. This is particularly noticeable in the years 1896, 1899, 1901, 1902. Now in the two latter years, 1901 and 1902, I happen to know that all diagnoses were made by the aid of the microscope, while in former years this was, I believe, not the case, and indeed, but a few years ago microscopical diagnosis of malarial fever, as a routine, was impracticable. At that time the diagnosis between simple continued and malarial fevers was entirely clinical, and great variations of practice occurred, many officers requiring marked periodicity to establish a diagnosis of ague, while others considered all fevers other than enteric occurring in a malarial climate, so called, as malarial in character. I suggest that these differences were mainly due to the influence of the personal equation, and that it is fairer to lump together all fevers, *i.e.*, malarial and simple continued, as "malarial fevers." In the accompanying Table IV. I have done this, giving in addition to the admissions for malarial and simple continued fevers the totals of the same and the ratio per thousand of strength. The great epidemic of 1901 and 1902 stands out with startling significance followed by the equally significant decline in 1903, 1904 and 1905. It was during 1902 and 1903 that the extensive works above described were undertaken. By the end of 1902 much of the clearing, filling and cementing had been finished and malarial admissions were dropping rapidly. By the middle of 1903 the larger drainage schemes were beginning to effect their object and the admissions for fevers were lower than had ever been the case before. This was still more marked in the two succeeding years when the works may be assumed to have attained their full achievement. Fevers in fact declined *pari passu* with the completion of the works. Was this a genuine case of cause and effect?

The following observations, taken from official reports, may be held to summarise the opinions of those on the spot, and therefore, perhaps, best capable of judging.

TABLE IV.

EUROPEAN TROOPS, ST. LUCIA.

Showing by years the Average Strength, the Admissions for Malarial Fevers, the Admissions for Simple Continued Fever, the Total Admissions for Fevers, Malarial and Simple Continued, and the Ratio per 1,000 of Strength.

Year	Average Annual Strength	Admissions for Malarial Fevers	Admissions for Simple Continued Fever	Total	Ratio per 1,000 of Strength
1895	236	68	12	80	339·00
1896	218	90	1	91	417·42
1897	264	78	5	83	314·39
1898	313	72	8	80	255·55
1899	242	11	23	34	140·50
1900	251	13	12	25	99·60
1901	318	181	2	183	575·47
1902	229	190	5	195	851·42
1903	221	27	1	28	126·69
1904	260	11	9	20	76·92
1905	244	8	3	11	45·08

1902. The Senior Medical Officer, Barbados, remarks: "Of 190 admissions for malarial fevers at St. Lucia, 117 occurred among No. 46 Company, Royal Garrison Artillery, living in newly erected barracks at Vigie . . . they had been four years in the station and were much debilitated."

The Officer Commanding Military Hospital, St. Lucia, writes: "Most cases occurred during January, February and March, all dry months—only 6 inches of rain—so that climatic influences alone will not account for increase which last year occurred in wet months . . . . No. 46 Company, Royal Garrison Artillery, were removed March 9th, to Pigeon Island . . . admissions at once fell . . . New barracks swarmed with mosquitoes bred in the marshy land near parade ground and the cocoa-nut swamp, and infected by the numerous natives employed in building . . . . something also attributable to debilitated condition of No. 46 Company . . . Vigie barracks were again inhabited—by West Indian troops, in July—and no excess of malaria occurred, but meanwhile the parade ground and cocoa-nut swamp had been drained and bush cut and cleared."

This draining of the cocoa-nut swamp refers to the first drain cut, which proved ineffective. The swamp was not thoroughly drained till the middle of 1903.

1903. The Senior Medical Officer, Barbados, attributes "the large drop in malarial fevers to drainage," and remarks that "similar drops in 1899 and 1900 were probably due to some extent to non-

inclusion of simple continued fevers as malarial fevers." The Officer Commanding Military Hospital, St. Lucia, remarks on "the excellent effect of the drainage works on the incidence of malarial fevers." He notes that "the St. Lucia Company, Royal Garrison Artillery, supplied most owing to the dense jungle surrounding their station at La Toc."

1904. The Senior Medical Officer, Barbados, says: "This large decrease is no doubt due to the sanitary improvements in barracks and immediate surroundings which have been carried out at St. Lucia, together with the attention paid to filling up of all small pools and likely breeding places of Anopheles and the general crusade against this insect." The Officer Commanding Military Hospital, St. Lucia, says: "The above offers a great contrast to previous years and goes to prove conclusively that the war waged against mosquitoes by clearing and draining has had a most beneficial effect."

1905.—The Officer Commanding Military Hospital, St. Lucia, notes that, in his opinion, "the continued freedom from malarial fevers is due to the influence of the drainage and clearing operations."

Thus all, *quorum pars minima fui*, unhesitatingly ascribe the great improvement in the incidence of malarial fevers on the European troops to the effects produced by the large drainage and other works, and the war against mosquitoes so diligently waged during those years. But it is only fair to ask if there were not other factors working, less obviously, perhaps, towards the same end, and, looking dispassionately at the circumstances after some lapse of time, there appear to me to be two whose influence may reasonably be held to have had some share in the result. These were the debilitated state of No. 46 Company, Royal Garrison Artillery, and the fact that the new barrack blocks at Vigie were re-occupied in 1902, not by European, but by non-European troops, amongst whom, as will be shown later, improvement was less marked, the fresh company, No. 84, Royal Garrison Artillery, being quartered in hutments on the top of Vigie hill. No. 46 Company, Royal Garrison Artillery, came to the island in 1898. They had therefore been stationed for no less than three years in St. Lucia. Many of them were infected, for they had been the principal contributors to the admissions during the previous years; they were anæmic and debilitated from long residence in the tropics; they were suddenly launched into a hive of infected mosquitoes, each man, as he was inoculated, becoming a centre of widening infection; the vicious circle was complete, and was

broken only by the removal to Pigeon Island. Doubtless the men's condition rendered the disease more virulent, and emphasised the contrast between the years before and after the drainage works, but can scarcely be held to weaken the evidence of their value. With regard to the second point, certainly the top of Vigie hill, 200 feet, was breezier, healthier, and less haunted by mosquitoes, and I have little doubt that the change of site had a decided influence on the reduction of malaria.

TABLE V.

NON-EUROPEAN TROOPS, ST. LUCIA.

Showing by Years the Average Strength, the Admissions for Malarial Fevers, the Admissions for Simple Continued Fever, the Total Admissions for Fevers, and the Ratio per 1,000 *of Strength.*

Year	Average Annual Strength	Admissions for Malarial Fevers	Admissions for Simple Continued Fever	Total	Ratio per 1,000 of Strength
1896	279	64	2	66	236·91
1897	256	55	5	60	234·37
1898	143	81	25	106	741·24
1899	295	29	52	81	274·89
1900	285	25	17	42	147·36
1901	293	70	5	75	256·31
1902	317	66	0	66	208·51
1903	330	56	0	56	169·69
1904	306	36	4	40	130·71
1905	255	49	5	54	211·76

Turning now to the non-European troops, Table V., it is noticeable that they have not shared in the improvement to an equal extent; also, with three exceptions, 1898, 1900 and 1904, the annual variations in incidence of malarial fevers are comparatively small. It appears to me that this mere regular incidence may be correlated with the domestic habits of the men. In the West Indies European and non-European troops are, as far as Service conditions go, on a perfect equality. They are housed, fed and clothed alike, although they inhabit different localities; but, being of the same race as the coloured inhabitants of the islands, they naturally mix more with them than do their European comrades. Very many of them are married, and are allowed to live out of barracks, and they are thereby much more exposed to inoculation by infected mosquitoes. Thus the general sanitary improvements, which were directed against the insanitary conditions in the vicinity of barracks, touched them less. Again, a considerable proportion

of the non-European troops consisted of the Local Company, Royal Garrison Artillery, who were quartered permanently at La Toc, a locality much surrounded by jungle, which had less money spent on it than Vigie or the Morne. This would tend to steady the rate, and may account for the less marked improvement since 1902, compared with the white troops. With regard to the exceptional years, 1898 shows a very high ratio of admissions, and the Officer Commanding Military Hospital remarks, that "severe remittent fever was prevalent at La Toc." 1904 shows a materially improved ratio, following a steady improvement in 1902 and 1903, which I have little hesitation in ascribing to the clearing and draining operations generally.

The phenomenal drop in 1899 and 1900 must be considered in connection with a very marked improvement in the admission-rate for fevers in those years among both European and non-European troops, following the remittent fever epidemic among non-European troops in 1898. In the preparation of this paper I had not at first intended to make use of statistics, but when quite recently I made out Tables IV. and V., I was at once struck by the general resemblance of the figures for the years 1898, 1899, 1900, and those for 1902, 1903, 1904. In both there was evidence of epidemic malaria followed in both by marked decline in the two succeeding years, the only apparent difference being that in one case the epidemic was among the non-European, in the other among the European troops. Yet my contention was that the improvement in the latter case was mainly or altogether due to the great and novel drainage operations of 1902 and 1903. How then was I to explain the similar sequence in 1898 to 1900? I found on further investigation that there was evidence of considerable sanitary works being carried out during those years. Thus in 1898 and 1899, "extensive building operations were going on at Vigie; Vielle Ville creek was being drained (marked Q in fig. 2.) and Vielle Ville barracks repaired." In 1899, "in addition to drainage operations of the previous year, surface drains at Vigie were cemented and extended to the sea," while in 1900 it is recorded that "the building operations are approaching completion and the surface gutters have been further improved." I find also, on reference to Lieutenant-Colonel Hodder's pamphlet, that he mentions, incidentally, that during 1897 to 1899 not less than £1,000 was spent on reclamation, drainage, concreting and bush-cutting. No mention is made of mosquitoes, and it may be supposed that these works were undertaken on the general assumption that drainage was good and marshes and jungle bad;

they were working in the dark but working on right lines. I suggest, then, that after the epidemic of malaria at La Toc in 1898, attention was specially directed to clearing, draining, and general sanitary improvement, that the large scheme of barrack construction probably aided in this by directing attention to the needs of the island, and that the improvement which followed was due to these measures. Although not specifically directed against mosquitoes, there may have been other factors at work to contribute to the result, just as there may have been in 1903, 1904 and 1905. We are, I think, too apt to indulge in special pleading, too apt to see comforting results from measures in which we are specially interested, too apt to take *post hoc* as equivalent to *propter hoc*, to let the wish be father to the thought, without sufficient criticism of paternity. We know so little of the habits, the conditions of existence of Anopheles, even less of the plasmodia they carry. We know little, with exactness, of the climatic conditions that favour their breeding, and are only beginning to recognise the fine adjustment of sun and shower which is requisite to that end. We have the vaguest ideas on their powers of travel. We cannot explain why certain breeds of mosquitoes exist in one place and not in another; why, for instance, Anopheles swarm in St. Lucia, yet cannot be found in Barbados, only eighty miles away, with constant communication.

But whatever other influences may have helped in the result, I am myself convinced that the main factor was the change in natural conditions produced by the drainage operations. They were conceived and carried out with one logical end in view—the destruction of mosquitoes; the results were obvious to all of us and were confirmed over and over again. Areas were marked out for clearing and draining, mosquitoes disappeared; if bush were allowed to grow, if the channels became blocked or inefficient, mosquitoes again appeared to again vanish under the scythe and spade. Constant effort and unremitting attention were necessary but met with their reward. Statistics bear out the argument and the results of previous measures reinforce it—measures directed to the same end, but without the definite aim that modern knowledge gives and temporary in their effects because unbacked by conviction and starved for lack of funds. For large works, like those undertaken in St. Lucia, mean both great initial outlay and considerable recurrent expenditure, as well as organisation of method, intelligent co-operation, and unremitting supervision. That very unfavourable localities can be freed from mosquitoes and thereby from malaria

I am convinced; whether the game is worth the candle is another question. The amount actually spent in St. Lucia in a little over two years on these drainage and clearing operations was almost £4,000, and another £5,000 was required to completely carry out our scheme. The annual recurrent expenditure was estimated at £1,000. Bush-cutting alone (three cuts per annum were necessary in that luxuriant climate) amounted to £600 a year at £3 per acre. The average cost per head of troops worked out at £2.

I ought, I think, to mention that the above experiment (for so it may be regarded) was uncomplicated by other prophylactic measures. Barracks were not mosquito-proofed with wire gauze, mosquito curtains were not issued to troops (except in hospital), and no issue of quinine was made. Reliance was placed entirely on clearing, draining, and general sanitation directed to mosquito destruction.

In concluding this paper I think I am justified in saying that a severe epidemic of malaria in St. Lucia led to very extensive drainage works, undertaken with the view of exterminating mosquitoes, which were followed during three succeeding years by a great and increasing diminution of malaria; that this is in accordance with similar experience elsewhere, and that the results justify us in urging expenditure on a considerable scale in cases where it is found necessary to station troops in malarious localities.

I wish here to acknowledge in the fullest manner my indebtedness to Lieutenant-Colonel Hodder, R.E., and the publishers of his pamphlet, The Royal Engineers' Institute. To the former I owe many hints and suggestions during our sojourn together in St. Lucia, to the latter permission to make use of figs. 1 and 2 (slightly altered for my purpose), Tables I., II. and III., and various quotations from the pamphlet, which I have acknowledged in the text.

ON THE VALUE OF BETA EUCAIN AND ADRENALIN AS A LOCAL ANALGESIC IN MILITARY SURGERY.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

During the past twelve months the following operations have been performed at the Military Hospital, Colchester, under the above analgesic :—

	Cases.
Excision of varices (chiefly of internal saphenous)	17
Excision of varicocele	8
Hammer toes (partial excision of first interphalangeal joint)	13
Removal of portion of dislocated semilunar cartilage	10
Removal of large synovial fringes from knee joint	2
Radical cure of inguinal hernia	9
Radical cure of double inguinal hernia	2
Ingrowing toe nail (under cocaine, 1 per cent.)	13
Removal of glands	4
Evacuation of deep cervical abscess	4
Excision of external piles	2
Suture of divided tendon	2
Amputation of finger	1
Amputation of toe	1
Removal of sebaceous cyst	3
Removal of enlarged olecranon bursa	1
Hare lip	1
Excision of vermiform appendix	5
Excision of head of radius (for recurrent dislocation)	1
Circumcision	110
Amputation of the male breast	1
Excision of large ganglion	1
Encysted hydrocele of cord	1
	212

The solution has been prepared according to Mr. Barker's formula, viz. :—

Beta eucain	3 grains.
Sodium chloride	12 ,,
Distilled water	3½ oz.

Mix, boil, and, when cool, add adrenalin chloride (1—1,000) ♏x.

In January, 1905, I was much struck by an operation which was performed at University College Hospital, by Mr. A. E. Barker, under the above analgesic, and it occurred to me that the possibilities of this analgesic in Army practice were very great.

At first, owing to imperfect methods, one was not very successful; but as time went on one became more expert, and

now it is quite exceptional to have to employ a general anæsthetic in this hospital.

The labour which is involved in nursing cases which have been operated upon under this method is, as may be readily understood, very much lessened.

In peace times the operations which are required in military hospitals are not of a very varied character, and I am strongly of opinion that the great majority can be performed quite satisfactorily under this method of local anæsthesia. I also think the soldier will more readily submit to operations of expediency if he knows they can be performed without "putting him to sleep." In small hospitals, if this method be adopted, it will be possible for the surgeon to undertake many operations single-handed. The only assistance he will require will be that of a trained orderly. In the field, or in naval practice, where the surgeon may be alone, the value of this analgesic must be enormous. For country practitioners one cannot conceive anything more valuable. It enables small operations to be done for patients who are unable or unwilling to go to the expense of an anæsthetist and a couple of trained nurses, or to expose themselves to the risk of a general anæsthetic.

A marked feature of these operations is their bloodlessness.

In using this drug the main points to be attended to are: (1) To provide oneself with a reliable syringe, which will not be out of order at the time it is required; (2) to make the solution freshly and so ensure its sterility; (3) soda must not be brought in contact with it for fear of decomposing the adrenalin; (4) to inject sufficient. It is quite possible to inject as much as 6 or 7 ozs. with safety. For the removal of the whole of the axillary glands on one side not less than 8 ozs. were used. It is quite a mistake to use the small quantities to which one was accustomed when making use of cocain solutions; (5) to wait for at least twenty minutes before operating. The injected parts are much less œdematous, and the landmarks are much less obscured, if one waits for three-quarters of an hour; (6) to use drainage for the first eighteen hours in all large operation wounds. Owing to the adrenalin the blood-vessels are emptied, and they remain in this condition for some considerable time. They are placed in very much the same condition as when an Esmarch bandage and tourniquet are applied to a limb. The natural consequence is that when the blood is readmitted a good deal more exudation occurs than when the same operation is done under a general anæsthetic. The tissues may

be able to deal with this fluid, but on the whole I think it is safer to make use of a drain for a few hours in all the larger operation wounds. Four strands of coarse silkworm gut answer perfectly; (7) to operate as gently and as tenderly as possible. Much tearing and dragging cannot be tolerated.

I should like to describe some of the operations which have been performed in detail.

Varicose Veins.—The skin of the affected parts is carefully prepared for at least two days, by shaving and thorough cleansing with turpentine and spirit soap. A carbolic compress is then applied and the patient walks to the theatre. The skin is finally cleansed, and the man is made to put all his weight on the affected limb. With carbolic fuchsin the outline of the dilated veins is marked on the skin, and also the upper part of the internal saphenous vein. In the case of varix of the external saphenous vein, the upper part of this is marked out. The eucain and adrenalin solution is then injected into the subcutaneous tissue round the affected veins for about half an inch on each side, and for one inch above and below the limit of the section which it is proposed to remove. The limb is then wrapped in a sterilised towel and the operation is not commenced for at least twenty minutes. The internal saphenous vein is then exposed through a *transverse* incision about 1½ inches long, and tied about 3 or 4 inches below the opening. In fat subjects, where the vein is not dilated at this point, this is by no means as simple an operation as it appears, and the vein is sometimes very difficult to find. This incision is sutured at once by continuous very fine silkworm gut and a dressing applied. A series of small incisions about three-quarters of an inch in length are then made at right angles to the line of the dilated veins and about 3 inches apart, commencing below. The exposed veins are clamped by Spencer Well's forceps, and cut across. By gentle traction, aided by a Watson Cheyne dissector, the veins are separated from their connective tissue bed as high up as possible, small tributary veins are clamped, cut across, and twisted and pulled until they break off. Through the next incision higher up the vein is clamped and cut across. The lower part is freed towards the lower incision as far as possible, and one forceps having been removed, the section is twisted out. The same procedure is adopted until all the dilated veins have been dealt with. It is advisable to close the incisions as they are finished with by continuous silkworm gut sutures, so as to avoid possible infection of these wounds. Fresh dressings are then applied, and a back splint

with foot piece is kept on for at least fourteen days. Spirit soap removes the fuchsin, so it must not be used to mark out the veins until the final cleansing has been carried out. In cases of varix of the external saphenous, this vein should be ligatured before its entrance into the popliteal vein. The amount of disturbance of the patient's skin and subcutaneous tissue which is involved by this method of operating, is very small as compared with the usual plan of making one long, or a series of long, incisions, and dissecting out the veins with their surrounding subcutaneous fat. No preliminary injection of morphia is usually required and no drainage is necessary for these cases.

Varicocele.—The subcutaneous tissue over the external ring, and just below it, is freely injected. The fine needle is then passed behind the cord close to the pubic crest, and about 3 drachms injected here. After an interval of about fifteen minutes, an incision about 1½ inches is made vertically below the external ring, and the cord is lifted from its bed, and pulled *en masse* out of the wound. Some more solution is now injected into the cord upwards and downwards. After a further interval of about ten minutes, the superfluous vessels are tied with fine kangaroo tendon and a section of about 2 inches removed. The ends of the upper and lower ligatures are tied together and a few points of catgut inserted so as to bring the cut ends of the vessels into apposition. The operation is completed by uniting the skin by a fine continuous silkworm gut suture. No morphia is required and drainage is unnecessary. The scrotum must be well supported, otherwise it becomes œdematous. About 1 ounce of solution is necessary for this operation.

Inguinal Hernia.—Before commencing to inject, give 6 minims of morphia hypodermically. In all large operations, and especially in nervous subjects, this will be found of very great assistance. It removes all fear and the natural expectation that some pain will be felt. Several patients have actually gone to sleep during the operation. A small patch of skin is injected just below the external ring, and after five minutes a fine trocar is pushed through this anæsthetic spot. The long blunt needle, with eye near the end, is then pushed through this puncture, and *while the fluid is being injected* it is sent in three or four different directions so as to flood the whole of the subcutaneous tissue of the operation area; about 1 ounce is required for this. After an interval of about fifteen minutes, the tissues are divided down to the external oblique aponeurosis. The blunt needle is then pushed up the inguinal canal, and about 6 drachms injected. After waiting for ten or twelve

minutes, the inguinal canal is laid open and the sac isolated. Owing to the action of the adrenalin, the sac is blanched and is identified very easily. Personally, I never strip up more sac than is required to push through the internal oblique after it has been transfixed and tied, but if the prolongation, which may extend into the scrotum, is removed, more solution must first be injected downwards into the cord. It is usually found that the sac can be stripped painlessly until a point is reached near the internal ring. It is advisable now to inject a little more fluid *into the substance* of the sac and into the internal oblique muscle. While this is acting I introduce the kangaroo sutures through the conjoined tendon and external oblique aponeurosis near Poupart's ligament, after MacEwen's method. The stripping of the sac and its transfixion and tying may now be completed. The stump of the sac is then pulled up through the separated muscle bundles of the internal oblique, twisted, and sutured in that position. The operation is then completed in the usual manner, and a silkworm gut drain put in at the highest part of the skin incision. This is, of course, the most dependent point when the patient is lying in bed with the thigh flexed. For an ordinary case, not less than 3 ounces should be injected, while if the subject is fat or the sac very thick and adherent, 4 or 5 ounces may be required.

Dislocated Semilunar Cartilage.—In this operation, the subcutaneous tissue is injected through a fine needle, and if the synovial membrane is found to be very thick or sensitive when grasped in a pair of forceps, it is advisable to inject some more fluid into it, and to wait for five minutes before proceeding further. Synovial fringes should be further injected before cutting them away. Morphia and drainage of the subcutaneous tissue only are required.

External Piles.—After a preliminary injection of morphia, inject the skin round the anus freely. The fine needle is then pushed into the pile and also into the mucous membrane at their inner side. After injecting, wait fifteen minutes. The pile is then dissected out, and the edges of skin and mucous membrane united by means of a fine curved needle and thin catgut. The operation is practically bloodless.

Hammer Toe.—Amputation of the whole of the second toe (which is the one usually affected) almost invariably leads to an increase of the *Hallux valgus*, which is commonly present, and a painful bunion. Complete excision of the first interphalangeal joint leads to a stiff toe. I have for some time past practised a very simple operation, which has given excellent results. The

affected toe is freely injected with the solution, care being taken that it travels well into the sole and up into the dorsum. After an interval of fifteen minutes, the knife is entered on the inner side of the toe, over the lateral ligament connecting the first two phalanges. It is carried in a curved direction through the skin as far as the outer side of the joint. The knife is again entered on the inner side, and carried with a curve in the opposite direction to meet the end of the first incision. The included piece of tissue containing the skin, with the usual corn and bursa, is removed. The extensor tendon and lateral ligaments are divided. It is not advisable to remove much of the extensor tendon, otherwise it will be found (owing to retraction) difficult to suture. The second and third phalanges are now forcibly depressed. This causes the head of the first phalanx to project into the wound. By means of bone forceps it is freely removed. It will now be found that when the toe is extended, the edges of the skin come into accurate apposition. The divided tendon is now sutured with fine silk, and some of the fibrous structures by means of the same material. The skin is united by finest silkworm gut. A straight splint is applied so as to keep the joint slightly over-extended. The result is a shortened toe, but it has perfectly movable joints. Care should be taken not to divide the nerves which run along the sides of the toe. The patient need not be kept in bed for more than a few days, after which he manages to get about on his heel. The splint is discontinued at the end of the third week, and by the end of the fourth he can wear his boots and walk comfortably. In very exceptional cases it may be necessary to divide the flexor tendon. The section of the bone is quite painless.

Removal of Vermiform Appendix.—Recently, five appendices have been removed under eucain. Six minims of morphia are first given hypodermically. Then a small patch of skin just above the anterior superior spine of the ilium is injected. After an interval of five minutes a fine trocar is pushed through the skin, and through the opening the long blunt needle is introduced, and the subcutaneous tissue of the operation area freely injected. After fifteen minutes a 2½-inch curved incision is made, one finger's breadth above the anterior superior spine and parallel to Poupart's ligament. This is carried through the external oblique aponeurosis quite painlessly. The long blunt needle is then pushed into the internal oblique muscle at the centre of the wound, and about 1 ounce of the solution is injected in four directions, care being taken to pass a good deal into the structures near Poupart's ligament. The fluid is always

injected as the needle is being pushed onwards. After a delay of five or six minutes, it will be found possible to forcibly separate the muscle bundles of the internal oblique and transversalis, and to reach the peritoneum quite painlessly. This structure may still be sensitive, but usually it can be divided at once. If not, some more solution may be poured into the bottom of the wound and a few minutes' further delay given. The patients' sensations when the finger is introduced into the cavity are various. One man vomited. In all the cases it was possible to withdraw the cæcum and identify the base of the appendix without very much discomfort being entailed. In two cases it became necessary to give about 30 drops of chloroform while the appendix was being withdrawn from the wound. The operation was then completed without further administration, and quite painlessly. In three cases no anæsthetic was required at all. In two more cases the appendix was so placed that its removal required full anæsthesia, after the abdomen had been opened under eucain. About 3½ ounces of solution are required, and drainage of the subcutaneous tissue is advisable for a few hours.

Circumcision.—Of the 110 cases of circumcision done during the year, the first eighty were done under 1 per cent. cocaine; the remainder have been done under eucain and adrenalin. No vessels require tying, and the operation is practically bloodless. If the prepuce can be fully retracted, and the solution injected into the mucous membrane near the corona, as well as into the subcutaneous tissue at the line of incision, the operation is absolutely painless. If retraction cannot be accomplished, a good deal of manœuvring is required to flood the usually thickened mucous membrane with the solution. To accomplish this, I push the needle obliquely through the skin at the line of incision (injecting all the time), until fluid escapes from the preputial orifice. I then (while still injecting) withdraw the needle until the flow ceases, and as soon as this is noticed, the injection is continued into the mucous membrane, in which the point of the needle is now known to be embedded. This is done at two other points, and after an interval of fifteen minutes the operation can be painlessly completed. I unite the edges of the divided skin and mucous membrane by a continuous suture of fine catgut, and apply a firm gauze bandage wrung out of 1 in 1,000 perchloride. The patient grasps the penis over the cut surface for half an hour, and then lets go.

I have not found Barker's eucain syringe a satisfactory one.

The rubber on the piston is not thick enough, and fluid is apt to escape above it when injecting under much pressure. The glass barrel is apt to get broken in sterilising by boiling. The aseptic needles which are supplied (size 17) are too fine, and necessitate a great deal of force to inject the solution through them into dense tissues. Size 12 are much more satisfactory, and are only about the same thickness as an ordinary hypodermic needle. Messrs. Allan and Hanbury have made me an all-metal syringe which is perfectly satisfactory. Barker's carriers are made to screw into the nozzle, so as to avoid leakage at this point.

I do not pretend that the whole of these operations have been *absolutely painlessly* performed. In doing the same operation in precisely the same manner on different subjects, one cannot help noticing that some will complain a little of the prick of even a fine needle, whereas others make no objection whatever. What I *do* contend is, that the amount of pain which is inflicted is very slight, and is certainly not more than a soldier should be expected to put up with. An ideal case is one in which the patient actually asks for his operation to be done under eucain. Soldiers are fond of talking about their operations, and in this way the news soon spreads through a garrison that cases can be successfully operated on in this manner. Moreover, for those who are keen on operative surgery, it is always well to bear in mind the check which would follow upon a death under a general anæsthetic in a military hospital. I am quite satisfied that many men have submitted to operative measures in this hospital lately, who would have refused to be done under general anæsthesia.

ENTERIC FEVER HISTORY OF THE 2ND BATTALION ROYAL FUSILIERS FOR THE YEAR 1906.

By Captain A. B. SMALLMAN.
Royal Army Medical Corps.

This regiment left Darjeeling, India, on November 5, 1905, for Secunderabad. While at Lebong two cases of enteric fever had occurred simultaneously, both imported, in men who had just returned from a course of mounted infantry training at Allahabad. On arrival at Secunderabad, on November 16, 1905, the regiment was placed under canvas, and remained so until February 15, 1906.

The first case of enteric fever was admitted to hospital on February 1, and the second case on February 6, 1906. They had lived in different tents. As soon as the cases were diagnosed, these two tents were struck and disinfected, while the other occupants of the tents were segregated, first at the rear of the main camp, afterwards, when the regiment moved into barracks, they were kept still under canvas, with latrine, wash-house and cook-houses separate from those used by all other men, at the spot marked B in the sketch-plan of the barracks. The third case was admitted to hospital on February 28, *i.e.*, twelve days after leaving camp, so that probably this infection also occurred in camp.

On looking round for a cause of infection in these three cases, it seems highly probable that the *materies morbi* was derived from a trenching ground lying about 2,000 yards south-east of the camp. During January and February flies were very numerous, and it is at least possible that they acted as the carriers. The trenching is done on the system of foot-wide and foot-deep trenches, filled to the top, and is unsatisfactory. The fourth case occurred among the men who were segregated at the spot marked B, in consequence of the occurrence of the first case, twenty days after removal from camp to barracks, so that it may have been either a case of infection by direct contact with Case 1, or infection in camp by means similar to those in Cases 1, 2 and 3.

I wish to direct particular attention to this Case 4, as I consider it highly probable that he formed the enteric connecting link between camp and barracks, the channel by which the infection was first introduced into barracks. This point will be referred to later.

Case 4 was admitted to hospital early in March. Three more

cases occurred in the same month. In April there was one case, in May three, in June one, in July three, in August five.

During this time all the precautions laid down in regulations and orders as to vacation of barrack rooms, segregation of men, disinfection of barracks, disinfection of clothing, &c., had been carried out whenever a case occurred, but without effect, for in the next month, September, there were no less than sixteen cases. The cases are shown in the sketch plan on the bungalows in the numerical order of their occurrence. It was obvious that the precautions hitherto taken had been of little or no avail. Suspicion then fell on the latrines as the source of infection, and especially on the latrines numbered 29, 30 and 31, in the bungalows nearest to which it will be seen that most of the cases occurred.

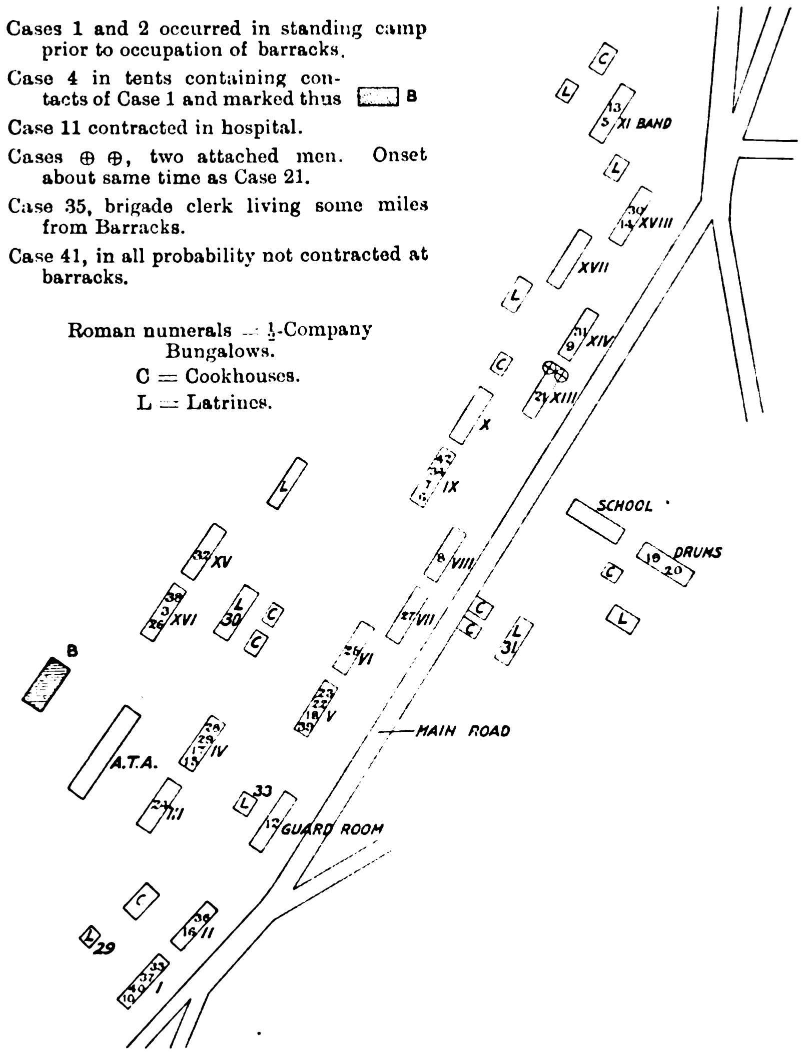
The worst of these three latrines was No. 30. It is a large one, serving three companies, and is placed on a space surrounded by six bungalows. It is, moreover, in close proximity to two cook-houses (marked C C on plan) which supply the same three companies, is old, of bad pattern and construction, and the so-called dry-earth system was in use. All the latrines in the lines suffer from the same defects.

It is at this point, I think, that the importance of Case 4, referred to above, is manifested. The large latrine is the one situated nearest to the tent in which Case 4 was segregated whilst incubating the disease. In all probability he used this latrine and infected it. It became a centre of infection from which, in time, most, if not all, of the latrines in barracks became infected; how, I am not prepared to say, but probably through the medium of the guard-room latrine, No. 33. But that this is not assumption, but almost completely proved fact, will, I think, be seen from the following. Acting on the assumption that latrines were the source of infection, the following experiment was carried out.

Early in October, the actual date varying somewhat, each latrine in turn was scraped and limewashed, and new pans were taken into use. Two or three pints of a solution (1 in 1,000) of corrosive sublimate were put into each pan before use, and subsequently all excreta, urine and fæces were boiled, a separate boiling place being established at the back of each latrine. No nuisance is caused by the boiling, and the well-known "latrine smell" has to a large extent disappeared, while flies are conspicuous by their absence from the latrines. Special European supervision was exercised over these processes, which are all still going on.

Taking the maximum incubation period of enteric fever as

twenty-eight days, if the assumption were correct that latrines were the main source of infection, a marked diminution in the number of cases ought to show itself, beginning from the end of October.



The result was as follows: Three cases occurred in October, one on the 5th, the other two on the 22nd, all well within the maximum incubation period, and, therefore, probably infected

before these sterilising processes were begun. Consequently they are negligible from the point of view of the experiment. From that time until the present date, two and a half months, only two cases, Nos. 41 and 42, have been admitted, and of these one can be almost excluded from latrine infection, since he only spent one night in barracks from the time of his arrival in the country up to the day he was admitted to hospital with enteric fever. In his case a much more obvious cause exists in the fact that he lived for some time in a segregation camp, where he mixed with convalescent enteric patients. The other case is a doubtful one. He is a twice inoculated man, who was admitted to hospital at the time that a number of malignant tertian malarial cases were occurring. His blood was examined for the malarial parasite, and found negative. The Widal reaction was positive in a dilution of 200, which is, in my opinion, too high for even a twice inoculated man, whose last inoculation had been done a year previously. Subsequently, he began to have evening rises of temperature, and the blood was again examined for malaria, with negative results; and yet, when quinine was exhibited, the evening rises of temperature stopped at once. It cannot be said, therefore, that the diagnosis in this case has been definitely established. An attempt to cultivate an organism from the blood stream was unsuccessful.

I think, therefore, we may fairly say that in this instance we have an example of infection derived mainly, if not wholly, from latrines. It is not simply a case of an epidemic dying out, for cases are still cropping up among other corps in the station where this method of latrine disinfection is not in use. No other precautions beyond those in daily use were taken at the time.

The lesson to be learnt from this experience would also appear to be clearly indicated, viz., the introduction of a water-carriage system of removal of excreta with subsequent bacteriological treatment. It is probably no exaggeration to say that with such a system the number of cases of enteric fever in the station might be reduced by about 90 per cent. in a very few years' time. The question of how exactly the infection is conveyed from the latrines to the intestinal canals of the men is another matter, and one that does not appear to be easy of solution. The usual "dust and flies theory" scarcely seems to meet all the requirements of the case, but the subject is one which requires very careful investigation. There are at least two advantages of this sterilisation system which may be appropriately mentioned here, viz.:

(1) The excreta can be removed to the trenching ground during

the day time, for the boiled excreta cause no nuisance, and possible "splashing" of the contents of the Crowley carts is not so important. Everyone is agreed that the day is the best time for removal when it can be done.

(2) Convalescent enteric patients, who are such a potent cause of spreading the disease, can be returned to their barracks with much greater safety when their excreta will be all sterilised.

I have thought it desirable to put this experience on record, for when knowledge of the causation of the spread of enteric fever in India is so much "in the clouds," as it still is, any little evidence of a fairly definite nature, such as this appears to be, must be of some value.

REPORTS OF THE COMMISSION APPOINTED BY THE ADMIRALTY, THE WAR OFFICE, AND THE CIVIL GOVERNMENT OF MALTA, FOR THE INVESTIGATION OF MEDITERRANEAN FEVER, UNDER THE SUPERVISION OF AN ADVISORY COMMITTEE OF THE ROYAL SOCIETY, PART V.

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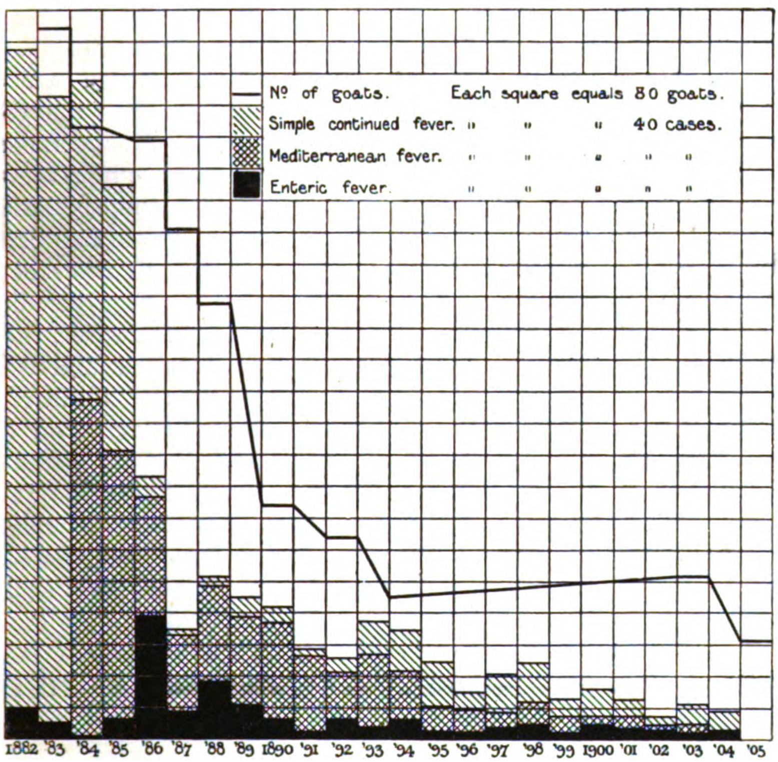
MEDITERRANEAN FEVER IN GIBRALTAR.

By Major W. H. HORROCKS.
Royal Army Medical Corps.

Mediterranean fever, often called "Rock fever," has existed in Gibralter for many years. Although the cause of the disease was not known until Bruce isolated the *Micrococcus melitensis* from fatal cases in Malta, medical men practising on the Rock knew of the existence of a fever which was characterised by long duration, low mortality, and liability to be followed by rheumatic sequelæ. In the Army Medical Department Report for 1878, it is stated that many of the cases of rheumatism were of an obstinate nature following attacks of Mediterranean fever, and in the report for the year 1880, mention is made of 194 cases of rheumatism associated with previous attacks of Rock fever. The civil health reports, furnished twenty-five years ago, do not contain any references to Mediterranean fever, but in the report for 1883 there is a statement that the civil population suffered from marked outbreaks of a fever which was not enteric fever and had a very low death-rate. An examination of the returns of the Colonial Hospital shows, however, that the local fever was rarely admitted into that institution. Dr. Turner, the senior colonial surgeon, wrote in a paper on the Rock fever of Gibraltar, published in 1883, "amongst the indigent poor of the civil community residing in the central districts of the town, I have attended at their homes during 1882 and 1883 over 900 cases of illness; of these 115 have been attributed to continued fever and but two have died. My experience in practice among the upper classes yields similar results. . . . Rheumatism is undoubtedly present in varying degrees of intensity in a large proportion of the cases." There can be no doubt that Mediterranean fever, as we know it now, was very prevalent both among the civil and military populations some twenty-five years ago. But as the continued

fevers were neither reported to the health officer nor admitted into the Colonial Hospital, except the cases were very severe, it is necessary to examine the military statistics in order to obtain an idea of the real prevalence of the disease. Until the year 1897, when serum diagnosis was practised, the fevers occurring among the military population were returned under the headings, Febricula, Simple Continued Fever and Enteric Fever. The term Remittent Fever was not much used except in connection with cases of fever developing in regiments which had recently arrived from stations where malaria was prevalent.



Undoubtedly the term Simple Continued Fever was used for febrile attacks of short duration as well as for cases of prolonged fever attended by marked anæmia and complicated by rheumatism, so that in order to make a reliable estimate of the probable number of cases of Mediterranean fever it has been necessary to examine the Army Medical Reports, the admission and discharge books,

and the case books preserved in the military hospital. A careful examination of these records, from the year 1884, shows that if cases of simple continued fever in hospital for fourteen days and under are eliminated, a large number of cases remain which are almost certainly Mediterranean fever. A few cases in hospital for sixteen to twenty days are doubtful, but as similar cases observed during the last three or four years gave a serum reaction with the *M. melitensis*, they have been included in the Mediterranean fever group. Prior to the year 1884 admission and discharge books are not available, so it is only possible to obtain a general idea of the wave of total fevers on the Rock from the Army Medical Reports. The figures given show that a wave of fever commenced in 1874 and reached a maximum in 1882, when 902 cases of fever were recorded. On the accompanying chart the total number of cases of continued fever are shown from 1882 to 1905, and from the year 1884 the proportional parts which enteric fever, Mediterranean fever and simple continued fever bear to the whole are represented by uniform shading, crossed lines, and simple diagonal lines respectively. It will be seen that in the year 1884 there were 833 cases of continued fever, of which 429 were probably Mediterranean fever. In 1885 there were 697 cases of continued fever, including 341 cases of Mediterranean fever. In the year 1886, however, there were only 331 cases of continued fever, and of these 158 were returned as enteric fever. The great increase in the number of cases was attributed partly to an infected regiment arriving on the Rock after service in the Egyptian War, and partly to serious sanitary defects in Town Range, Hargreaves and Buena Vista Barracks. The figures are probably correct, as 26 deaths occurred among the 158 cases of enteric fever. Besides the marked decrease in the number of cases of Mediterranean fever, the year 1886 is also remarkable for the practical extinction of simple continued fever. In 1887 there was again a considerable fall in the number of cases of Mediterranean fever, and from that date, with slight oscillations, the curve of Mediterranean fever gradually declined until it reached zero in 1904.

During the years under review the military population varied between 4,307 in 1886 and 5,031 in 1901, and at the time when the most marked fall in the fever curve occurred the population averaged 4,724. The rapid disappearance of febrile diseases from the Rock, which commenced in 1885, forms a marked contrast to the state of things in Malta during corresponding years. It is plain that some important cause of fever, which has vanished from Gibraltar, has continued to operate in Malta.

Having discovered (1) that the *M. melitensis* is excreted in urine of men and goats and that animals can be infected by dust contaminated with urine of patients suffering from Mediterranean fever, and (2) that the *M. melitensis* is excreted in the milk of infected goats and that the consumption of this milk causes Mediterranean fever in monkeys, it is evident that both sanitary conditions and possible infection of goats on the Rock must be investigated if the key to the problem is to be found.

Sanitary Conditions of the Rock.

Military Districts.—An examination of the Army Medical Department Reports shows that during the past thirty years there has been a gradual improvement in the sanitary condition of the military districts. In 1872-3 a main drain was made at the New Mole and glazed pipes were used; the joints, however, were made with clay and bedded in mortar. In 1886 the drainage of Town Range, Hargreaves, and Buena Vista Barracks was improved and the waste pipes of ablution rooms were disconnected from sewers. In 1887 the Principal Medical Officer reported that "the whole system of soil drains requires to be thoroughly overlooked, and nothing short of laying down new soil pipes can possibly meet the urgent requirements under this head . . . the present soil drains of *brick* are defective." In 1888 he stated that "a considerable number of sanitary improvements were effected in the different barracks during the year, principally as regards improvements in drainage, both by structural alterations and ventilation of existing drains." It was customary to make the joints in drainage work with clay up to the year 1890, and most of the drains were of the chair and saddle type. Fresh-air inlets, with mica flaps, for drains were first used about the year 1890. It is evident that up to the year 1888 the military drainage was extremely faulty, and the new work done up to the year 1890 still permitted pollution of the soil owing to the clay joints.

Civil Districts.—Up to the year 1865 the civil drains and sewers were constructed with bricks on the box pattern, and the sewage was discharged into the "Bay" on the west side of the Rock. During the years 1865-8 the box drains were removed and earthenware pipes of the chair and saddle type were laid in the north district of the town. A similar change was made in the south district during the years 1870-4. At that time there was no disconnection of house drains from tributary sewers, but in the year 1883 Weaver's siphon trap was installed on civil premises. In 1893 the building bye-laws were passed, and the chief requirements of

the Local Government Board model bye-laws were then insisted upon. Fresh-air inlets for house drainage, 4-inch soil pipes placed outside houses, and w.c.'s with separate flushing tanks, had to be provided in houses occupied by the civil community. In the year 1896 the new main sewer discharging the town sewage on the east side of the Rock was commenced, and the work was completed in 1898.

As the curve representing febrile diseases amongst the military population steadily rose from 1874 to 1884, it is unlikely that the improved civil drainage was the principal cause of the reduction of fever that suddenly commenced in 1885. The disconnection of civil premises from tributary sewers may have had an influence in diminishing febrile attacks among the civil population. Up to and including the year 1883 the civil health reports contain several references to outbreaks of fever, not enteric, amongst the civil population, but in the two years following the house disconnection febrile diseases are stated to be not so prevalent as formerly. There are, however, no figures in the Health Reports to support these general statements.

Examination of Goats.

Twenty years ago goats were allowed to graze on the upper portions of the western side of the Rock, and for this purpose passes were granted to goat-keepers by the Royal Engineers. On consulting the records in the office of the War Office Lands, it appears that in the year 1883 passes for 1,795 goats were granted. During the year 252 goats were sold; consequently, in 1884, there were 1,543 goats on the Rock. In 1886 the Royal Engineer records showed passes granted for 1,512 goats. In 1887 only 1,285 passes were given, and these were reduced to 1,104 in 1888. In 1890 the passes were reduced to 590, and in 1892 some 80 of these were cancelled. In 1893 the War Office took possession of the ground below Ince's Farm and 150 goats kept there at the time were sold. From 1894 to 1902 the number of goats appears to have changed very little. An examination made by Sanitary Inspector Balestreno at the end of 1903 showed 413 goats to be present. In 1904 the passes were reduced to 210, and when I commenced the examination of goats in 1905 I found 254 goats distributed on the various parts of the Rock.

It might be urged that though passes for grazing were withdrawn, the goats were still kept and fed in the goat-sheds. This, however, was not the case, as from information supplied by former goat-keepers, who no longer follow the trade, I have ascertained

that from 1883 to 1893 about 1,100 goats were sold. As many Maltese goat-keepers who used to keep goats have left the Rock, it is not possible to trace the fate of all the goats present in Gibraltar in 1883. Still, as the Maltese now following the goat trade assure me that goats were not kept in any numbers when passes for grazing could not be obtained, and as the War Office took over the land upon which many of the old goat-sheds were built, I think the figures given above may be taken as representing fairly accurately the number of goats on the Rock during the years mentioned.

It is interesting to note that in 1883 practically all the goats on the Rock were Maltese, and at that time regular shipments of goats from Malta to Gibraltar took place. *Pari passu* with the withdrawal of grazing passes and the increase in the cost of shipment, the importation of goats from Malta on a large scale ceased, and goat-keepers replaced their stock partly by importation of Spanish goats and partly by breeding. In this way three classes of goats were obtained, viz.: (1) Spanish goats; (2) Maltese goats, descendants of the goats originally brought from Malta; (3) "mixed" goats, obtained mainly by breeding from Maltese fathers and Spanish mothers.

Infection of Goats Existing on the Rock in 1905.—Specimens of blood were taken from 254 goats found on various parts of the Rock, and tested in the usual manner with a recent culture of the *M. melitensis*, dilutions of serum from 1 in 10 to 1 in 100 being made. The results obtained are given in the accompanying table, which shows that 14 per cent. of the goats gave a reaction with the *M. melitensis*. There appears to be very little difference between the infection (about 15 per cent.) of the Maltese and "mixed" breeds. Of the Spanish goats, however, only 11 per cent. seem to be infected. Samples of milk were taken from all the goats, except those that were pregnant, and tested for agglutination. The milk from Nos. 3 and 4, both Maltese goats, in goat-shed No. 1, Engineer Road, caused immediate clumping of a rich emulsion of the *M. melitensis*. None of the other samples of milk, whether from infected or non-infected goats, gave any signs of a reaction. Ten cubic centimetres of each sample of milk were then centrifugalised and the deposit plated on glucose-nutrose-litmus-agar. Numerous colonies of the *M. melitensis* were found in the plates made with the milk from the Maltese goat No. 4, Engineer Road. It was expected that the specific organism would also be found in the milk of goat No. 3, Engineer Road, but though it was repeatedly examined, no signs of the *M. melitensis* could be detected. Five cubic centimetres of blood were taken from goat No. 4 on three different occasions and planted out in broth, but no growth occurred. An examination of the milk was

made at frequent intervals during the next three months, but the *M. melitensis* never appeared again; consequently, it would seem that goat No. 4 had not been recently infected.

It will be noticed that the dilutions of the sera which reacted with the *M. melitensis* are mostly low, only two sera reacting in a dilution of 1 in 100 and six in a dilution of 1 in 50. These reactions also suggest that many of the goats are probably in a late stage of the disease. A re-examination of the goats made six months later proved this to be the case, as the sera which formerly reacted in dilutions of 1 in 100 and 1 in 50, then only reacted in dilutions of 1 in 20 and 1 in 10, and many of the sera reacting in dilutions of 1 in 20 and 1 in 10 gave no reactions at all.

Further evidence of infection, not of recent date, was also obtained by examining the cows in Mr. Patron's dairy. These cows are kept under exceptionally good sanitary conditions, and though they are stall-fed in Gibraltar, a constant interchange with cows kept at the farm in Spain is kept up. When I commenced the examination there were twelve cows in the dairy and forty-nine cows at the farm. The serum of one of the cows (Huelfanita) in the dairy, when diluted 1 in 100, caused instantaneous clumping of the *M. melitensis*. This cow had recently calved, and was in a bad state of health owing to a retained placenta. The first secretion of milk, diluted 1 in 100, was also found to agglutinate the *M. melitensis*. During the next fourteen days 30 cc. of the milk were centrifugalised daily and the deposit plated. The *M. melitensis* was never recovered. A week later the cow died, and at the *post-mortem* examination the spleen was found small and firm in consistence; the glands also were small and fibrous in texture. Cultures were made from the spleen, glands, liver and kidneys, but no signs of the *M. melitensis* appeared. From the appearances found at the *post-mortem* examination it is certain that the cow, Huelfanita, had not been recently infected. The cows at the farm were next examined, and the serum taken from one of them, when diluted 1 in 20, was found to react with the *M. melitensis*.

Mode of Infection of the Goats on the Rock.—It appears probable that infected goats were imported amongst the herds brought from Malta, but the disease now existing cannot have a direct Maltese origin, as very few goats belonging to the imported stock now remain, and none of these are infected. It might be suggested that many of the goats now on the Rock are not really infected, and that the serum reactions given by the descendants of the old stock are due to agglutinations transmitted *in utero* from infected parents. In the last report of the Mediterranean Fever Commission it was

shown that agglutinins are sometimes transmitted from an infected mother to the kid. The transmission of agglutinins was also noticed in the case of several kids born of infected mothers in Gibraltar, and the serum of the calf of the cow, Huelfanita, mentioned above, was also found to agglutinate the *M. melitensis*. But as these agglutinins did not persist for more than six weeks, and the serum reactions given in the table were found little changed at the end of three months, it is not likely that they were caused by agglutinins transmitted from infected mothers, and the goats must be considered really infected.

The transmission of the *M. melitensis* from mother to kid could not be demonstrated in Malta, and in Gibraltar two apparently infected kids were killed immediately after birth, and cultures were made from the organs. Though more than eighty cultures were made, not a sign of the *M. melitensis* could be discovered. It is evident, therefore, that the disease now existing amongst the goats must have been acquired on the Rock. In previous reports I have shown that the *M. melitensis* is excreted in the urine of goats, and that healthy goats can be infected by food contaminated with urine containing the specific microbe. The evidence obtained from a study of the goats in the shed at Palace Gully Steps strongly supports the idea that this is a mode of infection now operating amongst the goats on the Rock. The goats were first examined at the end of October, 1905, and five goats were found to be infected. At the end of March, 1906, the herd was re-examined, when five other goats, which were found perfectly healthy at the first examination, showed a blood reaction, and from the milk of one of these goats the *M. melitensis* was isolated. The goats became infected during the winter months, when biting flies and mosquitoes were not to be found.

I noticed, however, that the coats of the goats were infested with pediculi, and as many of these were full of blood, I thought they might possibly act as a means of conveying infection. Accordingly, specimens full of blood were taken from infected goats and thoroughly washed with water, the thorax and abdomen were then washed with a sharp, curved bistoury, and the blood and viscera were transferred to a sterile glass slide. A little sterile salt solution was then added, and the blood and viscera having been thoroughly mixed with it, the mixture was drawn up in a capillary pipette and then plated on glucose-litmus-nutrose-agar. More than 150 pediculi were examined in this manner, but no signs of *M. melitensis* were discovered.

The goats in the shed at Palace Gully Steps, during the winter

months, were under the same conditions as the contact experiments related in the Fourth Report, in which diseased and healthy monkeys were allowed full contact, mosquitoes and flies being excluded by mosquito netting. Under the conditions described, healthy monkeys became infected by associating with diseased monkeys, and the infection could only be attributed to Micrococci contained in the urine of the infected monkeys. Other sources of infection being excluded, it appears certain that goats, during the winter months, may become infected in this manner.

During the summer months it is possible, as I stated in the Fourth Report, that goats and cows may be infected by mosquitoes which have fed on infected men and animals; but of this mode of infection I could not obtain any evidence. In one shed, during the summer months, a healthy herd of goats was only separated by a wooden partition from diseased goats, but no infection of the healthy goats occurred, though *Culex pipiens* and *Stegomyia fasciata*, which have been shown to act as carriers of the *M. melitensis*, are found abundantly on the Rock. This result I attributed to the facts that there were no cases of Mediterranean fever amongst human beings in the vicinity of the goat-sheds, and that the infected goats were in a chronic state of the disease, no evidence of the presence of the *M. melitensis* in their blood or milk being obtainable at the time.

The evidence of disease amongst the Spanish goats in Gibraltar was very interesting, and raised the question whether goats living on the hills and in the towns in Spain are infected. The Spanish goats living on the Rock were always associated with goats of the Maltese and "mixed" breeds, so they might easily have become infected in the manner just described. But as goat-keepers are now introducing Spanish goats to replace the Maltese, it was of great importance to find out whether those entering the Fortress showed any signs of disease. With this object in view I examined a herd of fifty goats living in sheds on the hills ten miles from Gibraltar. The goats were all pure Spanish breed and, so far as I could ascertain, had never been associated with Maltese goats or lived in the neighbouring towns.

Specimens of blood were taken from the goats and examined in the usual manner, but no serum reactions with the *M. melitensis* were obtained; all the goats appeared perfectly healthy. Different results, however, were obtained when I examined goats which had lived in the Spanish towns of Malaga and Linea. The goat-keepers informed me that the goats they were then importing came from Malaga, and I was led to suspect that these goats might be infected.

Situation of goat-shed	Number of Goats: Spanish (S.)	Maltese (†)	Mixed (M.)	Total	Number of Infected Goats: Spanish	Maltese	Mixed	Total	Infected Goats: Age	Place of birth	Dilution of serum reacting with *M. melitensis*: 1/10	1/20	1/50	1/100
									Years					
Palace Gully Steps	13	19	5	37	0	3	2	5	(1) M. 2	Gibraltar	+	+	+	+
									(2) M. 2	,,	+	0	0	0
									(3) † 1	,,	+	+	0	0
									(4) † 4	,,	+	+	+	0
									(5) † 6	,,	+	0	0	0
Lime Kiln Gully	1	1	13	15	0	0	5	5	(1) M. 6	Gibraltar	+	+	0	0
									(2) M. 2	,,	+	+	0	0
									(3) M. 2	,,	+	0	0	0
									(4) M. $1\frac{6}{12}$ ..	,,	+	0	0	0
									(5) M. 4	,,	+	0	0	0
Engineer Road, Goat-shed No. 1 (F.F.)	1	29	1	31	0	5	1	6	(1) † 3	Gibraltar	+	0	0	0
									(2) † 5	,,	+	+	+	0
									(3) † 2	,,	+	+	+	+
									*(4) † 3	,,	±	0	0	0
									(5) † 2	,,	+	0	0	0
									(6) M. 3	,,	+	0	0	0
Engineer Road, Goat-shed No. 2 (T. D.)	10	13	0	23	0	3	0	3	(1) † 3	Gibraltar	+	0	0	0
									(2) † 2	,,	+	0	0	0
									(3) † 2	,,	+	0	0	0
Engineer Road, Goat-shed No. 3 (T. V.)	8	0	29	37	0	0	0	0	—	—	—	—	—	—
Engineer Road, Goat-shed No. 4 (A. C.)	8	1	10	19	3	0	1	4	(1) S. (on the Rock $2\frac{3}{12}$ years)	Spain	+	0	0	0
									(2) S. (do., 3 years)	,,	+	0	0	0
									(3) S. (do., 4 ,,)	,,	+	0	0	0
									(4) M., age 4 ,,)	Gibraltar	+	0	0	0
Naval Hospital Hill	5	8	15	28	1	1	3	5	(1) S. (on the Rock 6 years)	Spain	+	+	0	0
									(2) M., age 4 years	Gibraltar	+	0	0	0
									(3) M., ,, $1\frac{2}{12}$,,	,,	+	0	0	0
									(4) M., ,, 4 ,,	,,	+	0	0	0
									(5) †, ,, 5 ,,	,,	+	0	0	0
Rosia	10	8	21	39	3	2	3	8	(1) S. (on the Rock 2 years)	Spain	+	0	0	0
									(2) S. (do., 6 years)	,,	+	+	0	0
									(3) S. (do., 4 ,,)	,,	+	+	+	0
									(4) †, age 3 years	Gibraltar	+	0	0	0
									(5) †, ,, $2\frac{6}{12}$,,	,,	+	+	+	0
									(6) M., ,, 3 ,,	,,	+	0	0	0
									(7) M., ,, $1\frac{8}{12}$,,	,,	+	0	0	0
									(8) M., ,, $1\frac{8}{12}$,,	,,	+	0	0	0
Catlan Bay ..	0	9	7	16	0	0	0	0	—	—	—	—	—	—
Almeda	6	2	1	9	0	0	0	0	—	—	—	—	—	—
Total ..	62	90	102	254	7	14	15	36	—	—	—	—	—	—

* Note.—The *M. melitensis* was recovered from the milk of No. 4.

as I had learnt that when the great exodus of goats from the Rock occurred, many of them were taken to Linea and Malaga, as well as to Oran, Algiers, Tangier and other towns on the African coast. The appearance of some of the goats arriving from Malaga also suggested an admixture of Maltese and Spanish breeds.

Just after I had examined the Spanish country goats, a small herd of sixteen goats was brought from Malaga, and, after living in Linea for three months, was allowed to enter the Fortress. I immediately visited the herd and found that while ten were obviously pure Spanish goats, six showed distinct evidence of a Maltese strain. Samples of blood were taken and the sera were tested in the usual manner. Two of the Spanish goats gave reactions when the sera were diluted 1 in 10, and two of the mixed breed also gave a reaction, one with the serum diluted 1 in 50 and the other with the serum diluted 1 in 10. Samples of milk were then obtained, and 10 cc. of each having been centrifugalised, the deposit was plated in the usual manner. Each sample of milk was also tested as to its agglutinating action on the *M. melitensis*. The results were uniformly negative; no signs of the specific microbe were observed in the plates and the milk had no agglutinating power. The goats in this small herd were previously in much the same condition as many of the goats now living on the Rock, notably those found in the shed at Palace Gully Steps.

At the first examination the milk of the infected goats in the shed did not contain the specific microbe, and had no agglutinating action, and yet other healthy goats associating with them became infected. Consequently, the admission of goats from towns in Spain cannot be considered free from danger, and in the interests of the public health it is plain that all goats brought to Gibraltar should be quarantined until examinations of the blood have shown them to be free from infection.

Conclusion.

It appears probable that the rapid disappearance of Mediterranean fever from Gibraltar, which commenced in 1885, was intimately associated with the exodus of infected goats from the Rock. Improved sanitary conditions, especially the disconnection of waste pipes and house drains from sewers, may have played a part in causing the decrease of fever, but as the same sanitary improvements have been carried out in Malta without any corresponding decline of Mediterranean fever, it is fair to assume that their effect was insignificant compared with that produced by the removal of infected goats.

NOTES ON LOCAL ANALGESIA.

By Captain J. W. H. HOUGHTON.
Royal Army Medical Corps.

As operations under local anæsthetics are now extensively performed, a note on a convenient method of inducing the necessary analgesia may be of interest.

There are many drugs on the market capable of producing a painless area on hypodermic infiltration, such as cocaine, eucaine hydrochlorate, eucaine lactate, stovaine and tropacocaine. Each drug has its advocate, who claims for his particular preparation some property or excellence denied to the remainder. Some difference of opinion also exists as to the strength in solution which induces the most satisfactory analgesia. These differences are in many cases due to varying techniques.

The substance used by the writer for producing analgesia is the hydrochlorate of beta-cocaine, chemically known as benzoylvinyldiaceton-alkamin, and the strength used is one part in 500 of distilled water, with 0·8 per cent. of sodium chloride, to which is added adrenalin chloride. This solution is that published by Mr. A. E. Barker in the *British Medical Journal* for December 24th, 1904. The formula for its preparation in a convenient quantity is as follows: beta-eucaine hydrochlorate 0·2 grammes; sodium chloride (pure) 0·8 grammes; distilled water 100·0 cc.

To make the solution, a glass beaker of about 300 or 400 cc. capacity is obtained and 100 cc. of distilled water poured in; to this is added a powder containing 0·2 grammes eucaine and 0·8 grammes sodium chloride, and the contents are boiled. After a few minutes' boiling the beaker is cooled to blood-heat by placing it in cold water, and 10 drops of a 1 per 1,000 solution of adrenalin chloride are then added and the analgesic fluid is ready for use. The addition of the adrenalin prolongs the analgesia by contracting the smaller blood-vessels and retaining the eucaine at the site of injection. It can be obtained in sterile bottles, but loses its properties on boiling or on admixture with an alkali. The toxic effects of injections up to 200 cc. of a 0·2 per cent. eucaine solution, *i.e.*, 4 deci-grammes of eucaine, are inappreciable, and this amount is ample for the infiltration of most operation areas.

The osmotic tension of a fluid injected into the tissues is of paramount importance. It has been found experimentally that a

0·9 per cent. solution of sodium chloride in distilled water has the same freezing point as blood. Now an injection of a 0·9 per cent. solution of sodium chloride in distilled water into the tissues does not lower their vitality or produce any harmful result, but the injection of a solution of sodium chloride below 0·55 per cent. or above 2·5 per cent. causes pain at the site of injection and lowers the vitality of the part. Hence the addition of 0·8 per cent. sodium chloride, which, with 0·2 per cent. eucaine, makes an isotonic solution. A syringe of about 10 cc. capacity, with a fine needle, and capable of being boiled, completes the outfit.

To give an illustration of the technique employed: suppose a patient with varicose veins requires their excision. The skin having been prepared and the position of the vein marked, the solution and syringe are sterilised. The needle is thrust under the skin beside the vein and the solution injected. A wheal is formed and the skin is raised by the injected fluid over an area of about 1½ inches in length and ½ an inch in breadth. The needle is now withdrawn and inserted at the extremity of the wheal where the sensibility is decreased, and more solution injected. The tissues on each side of the vein are injected in this manner until the infiltrated area is of sufficient extent to meet the requirements of the operation. Twenty cc. of the solution are usually sufficient. Half an hour is allowed to elapse before the operation is begun, during which time other cases can be infiltrated or the surgeon's hands and instruments receive their final sterilisation. This time is necessary to allow the eucaine to exert its maximum effect, when the infiltrated area becomes plainly visible; this is due to the ischæmic area caused by the adrenalin showing white in comparison with the surrounding skin, while the infiltration œdema has in a great measure subsided.

For the removal of a finger or toe a different method is available. Suppose amputation of the terminal phalanx of a digit is necessary. The needle is inserted at the base of the finger. Eucaine solution is injected superficially and deeply on all sides, and a distended ring is formed around the base of the finger, the object in view being to infiltrate all the nerves to the part, both the deeper nerve-trunks and the finer superficial nerve-twigs, and thus to produce a break of nerve conductivity at the level of the injection. The terminal phalanx is thus rendered analgesic by the physiological block to its nerve supply. Such a method may be termed "regional analgesia," as distinct from "infiltration analgesia," where the actual site of operation is infiltrated. The

regional method is very suitable for operations on the penis, such as circumcision.

The term "analgesia" has been used in preference to "anæsthesia" as being more accurate. Absolute insensibility is seldom produced; the patient can usually feel that something is being manipulated during an operation, though he has no sensation of pain or any definite sense of the manipulation.

There are several points of interest in connection with this procedure, especially its safety, comparative simplicity and utility where the services of a skilled anæsthetist are not available. These considerations may appeal differently to the surgeon in a well-equipped hospital and to the lonely medical officer in charge of an isolated station, but their discussion here is inappropriate. Some practical hints are, however, worth noting. When operating it is inadvisable to allow the patient a view of the proceedings or to ply him with questions as to his sensations. If he has pain he will immediately notify the fact without encouragement. A newspaper, a cup of tea or coffee and a smoke are usually sufficient as mental sedatives for a soldier, though a hypodermic of morphia may advantageously be given to a nervous subject. The analgesia lasts long enough for any minor operation, sensation generally returning after two or three hours. As sensation returns the patient may experience slight pain in the operation area, but it is doubtful whether the pain is greater than that following an operation under general anæsthesia, and a narcotic is seldem required for its relief. The ischæmia produced by the adrenalin makes many operations almost bloodless, while hæmorrhage need not be feared as the ischæmia passes off.

The following is a list of operations recently performed at the Military Hospital, Millbank, under local analgesia: For radical cure of hernia 7, for varicocele 7, for varicose veins 7, removal of small cysts 5, removal of internal semilunar cartilage of knee-joint 3, amputation of toes or fingers 3, for necrosis of bone 1, removal of breast (male) 1, for external piles 1, circumcision 2.

THE ORGANISATION OF PHYSICAL TRAINING. NORTHERN COMMAND.

By Lieutenant-Colonel S. WESTCOTT, C.M.G.
Royal Army Medical Corps.

The Director-General, Army Medical Service, having in June last expressed his deep concern at the increased loss of men to the Service from cardiac disorders, and his suspicions that physical training might be responsible, the General Officer Commanding-in-Chief directed the Medical Inspector of Recruits, in conjunction with the Superintendents of Gymnasia and Commanding Officers, to make a systematic inquiry with a view to discover if any injurious effects were being caused by the present system of physical training or by any other influence in the daily life of the recruit, and if so, at what period the defective method operated, and how it could be remedied. For the purposes of the inquiry the Army Medical Reports for the last twenty years were consulted, and the invaliding-rate for cardiac disorders was found to have continued at the nearly uniform annual rate of about 3 per 1,000.

A scheme of observation was then devised in which the condition of the heart and circulatory system was utilised as an indicator. By causing large numbers of men to run for three minutes, and then examining their hearts and pulses, it was determined that a normal recruit should resume a state of cardiac repose in five minutes; therefore, at the monthly visit of the Medical Inspector, every recruit at each depôt was tested in this manner, and a record kept of his progress, in order that should any defect arise during the training, its causation could be investigated. It was discovered in this way that a large number of originally healthy hearts became irritable or otherwise damaged; some of them even during such an early period as the first week.

The influence upon the heart, the blood pressure, and the nervous system, of each exercise which the recruits could be called upon to perform, either during their ordinary drill or in the gymnasium, was then investigated; and also the influence of cigarette smoking. The fault was found to lie in the manner in which the exercises were taught in the gymnasia, the outcome of a praiseworthy desire on the part of the sergeant-instructors to excel, a desire which was encouraged by a system of allowing each instructor to take his squad through the several courses of the

syllabus to the time of his departure for the regiment, thereby engendering a spirit of competition which invited a method of survival of the fittest. The remedy is very simple in principle, but a little difficult in application when it is required to supplant the custom of ages. This can only be accomplished by the education of all concerned in the training of the soldier in the simple physiological principles of exercises, and by their conviction of the truth of these.

Owing to the personal interest in this subject taken by the General Officer Commanding-in-Chief and the Brigadier-General in charge of Administration, and to the hearty co-operation of the Inspector-General of Gymnasia and his staff, action has been taken which has already resulted, in many depôts, in the adoption of correct principles and practice, with complete success.

The difficulty in dealing with this subject is due to the concealed nature of the trouble. The initial symptoms of cardiac strain or disorder, are not evident to the sufferer or to the onlooker. It is not the custom to watch in a systematic manner for them; they continue unsuspected, until some day, when perhaps a man is not in his usual health and condition, he is called upon to perform some extra exertion, and for the first time becomes aware of palpitation, pain, and breathlessness. He goes to hospital, is found to be suffering from "D.A.H." or "V.D.H." and, after a short attempt at cure, is invalided. The sequence of events is so hidden and the termination so sudden, that no impression is made on anybody; yet if we take up an Army Medical Report for any year since the commencement of its publication, we see heart disorders heading the invaliding-rate in every part of the Empire. The following memorandum will explain the nature of the changes introduced.

Memorandum.

Officers commanding depôts are to frequently avail themselves of the services of the medical officer as regards the exercises to be performed, and consult with him as to the effect of these exercises on the recruits.

The recruits are on joining to be placed in No. 1 squad, out of which squad they may not be passed without the concurrence of the medical officer. On leaving No. 1 squad they will join No. 2 squad, and the same procedure will be adopted as with No. 1 squad, viz., when considered fit by the officer commanding to be advanced to No. 3 squad, the concurrence of the medical officer must be obtained before they are advanced. His opinion, naturally, is not required in relation to anything other than the physical condition of the recruit. This course will be adopted as the

recruit becomes qualified for advancement from squad to squad, it being clearly understood that no recruit is to be passed to a more advanced squad without the concurrence of the medical officer.

The squads are to be treated in exactly the same way as the classes at a school, that is, the recruit joins the lowest and by degrees attains to the highest. The squad instructors are not to be moved with the recruits, but are to remain with their squads in exactly the same manner as a master remains with his class or form.

During the first fortnight no recruit is to attend the gymnasium, and during the second fortnight, if attending, is not to use any apparatus while in Nos. 1 and 2 squads.

These orders are issued as the result of a series of careful experiments carried out for a long period by the Medical Inspector of Recruits and those working with him. It has been proved that certain exercises hitherto considered beneficial to the training of a recruit, although putting on muscle, injuriously affect the heart of an untrained man, but with carefully graduated exercises the weakest heart can, as a rule, be strengthened to almost any degree.

The adoption of this system of organisation has enabled the training of each recruit to be graduated according to his ability. The pupils remain in one class until they are fit to go on to the next, instead of being pushed on under one instructor, automatically, the good with the bad, towards the top. Under the new system it is possible for a strong man to pass through the various classes quickly; and for a weak one to proceed more slowly, or to be discharged, if he is not fit to leave the lower squads in a reasonable time. The study of the lower squads also is a most valuable aid to recruiting; it teaches the medical inspectors the standard of quality of the recruits being raised in the various districts, and enables him to regulate it. The new system is controlled by a conjoint weekly examination of every recruit by the commanding and medical officers; every man is tested in the manner before described by runs of three minutes and five minutes rest. During the first fortnight the recruits do no physical drill; the time occupied in this way under the old system is now employed in military education, the choice of subjects being extended to Section 43 in the Manual. Of men who have been fourteen days at the depôt those with normal hearts are passed to No. 2 Squad, and those whose hearts are weak or irregular to a special training squad under the immediate supervision of the medical officer. To this squad also are relegated recruits from the higher ones, should their hearts be found to be abnormal. The treatment of this squad

is still in the experimental stage; at present it is by graduated running, but I am not sure that resistance exercises would not be better; the results, however, are very good. The men run for half a minute and then rest until their hearts resume the condition in which they were at starting. Three minutes' rest is required as a rule at first, then after a short time the rest is reduced to two minutes. This routine is carried out at two parades of half an hour daily, the period of running increasing, and the interval of rest shortening, according to circumstances. All classes are able to work in the same squad by dividing it into sub-sections, which are halted at varying periods of the run according to circumstances. The classes are regulated by finishing once a day, or on alternate days, by a minute's run near the hospital; it is then a few minutes' work for the medical officer to regulate the classes.

The management of this system was quite alarming at first, but there are now depôts in the command, under officers who are convinced of its soundness, and assisted by medical officers who are interested, in which there is not a single man over fourteen days' service whose heart is not absolutely sound and strong. There are still depôts, however, in which the hearts of the recruits, instead of becoming stronger, become weaker and more irritable as their training proceeds. But these are receiving marked attention, with every prospect of ultimate success. The difficulty lies in the conviction of the training staff at the depôts. Traditions of centuries cannot be altered in a day, or by the publication of orders; it is a little extra work and trouble to watch the training more closely at *first*, but once the new principles are established, the work is reduced to zero; there is no breakdown, no work. To effect this change an extensive system of co-ordination is required. The Medical Inspector must work with the Superintendents of Gymnasia as expert advisers of the Officers Commanding, who are immediately responsible for the training. The support of the General Officer Commanding-in-Chief and the Brigadier-General of the Command, and of the Brigadiers commanding the Grouped Districts, is essential. The Inspector-General of Gymnasia must approve, and Commanding Officers of regiments must not exact the muscular standard of a Hercules from the eighteen-year-old recruit of three months' training.

The fault of the old system of physical training is its forced nature. The exercises in the Manual are all that can be desired for the training of the recruit without danger of heart strain, but they are not classified, or used on any principle, other than that

of rapid and extreme muscular development. In a short "Guide,"[1] composed at the request of the General Officer Commanding-in-Chief, I have explained the physiological principles of exercise, and classified the various exercises according to their physiological effects. It is in popular language, but is based on the study of the physiological effects of the various exercises on large numbers of recruits during a period of six months, the results of which will shortly be published.

In addition to the adoption of a new organisation and new principles, another little change is required. It is my opinion that the recruit is given too much physical drill, which is dull and unproductive labour, and has the opposite of the desired effect. His reserve of strength, instead of being utilised to build up his body and make it strong and enduring, is strained to the utmost to produce a showy condition of muscular smartness. The requirements can be met by a slight alteration in the syllabus; eight hours only in each fortnight should be apportioned to physical drill, which should at first be of a developmental nature, followed later, by exercises of speed, as explained in my "Guide." The time which is saved should be devoted to education in that kind of military knowledge which the commanding officers of regiments mostly require of a recruit joining from a depôt. Then the recruit should be early habituated to marching and the use of the rifle, not by long, fatiguing route marches, but by short, frequently repeated educational marches. No march should ever be performed without a purpose; the brain should be exercised from the first, and the physiological principles of exercise should be observed. This system of prevention is operative only up to the time at which the recruits leave the depôt to join their regiments; in some future period it is to be hoped that it may become possible throughout the Army.

The training of the Militia, which is composed of younger and softer material than that of the Line, should be carried out with still greater precautions against forced exercises, and in the Garrison Artillery Militia the use of heavy metal shells for drill purposes during the first period of training should be abolished in favour of wooden dummies.

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[1] Published by Sampson, of Coney Street, York, and sold at 6d. per copy.

A NEW FIELD SERVICE FILTER.

By Lieutenant-Colonel R. H. FIRTH.
Royal Army Medical Corps.

The need of a good type of filter, capable of delivering a considerable volume of safe water and transportable under circumstances where wheel transport is impossible, has long been felt. For some months we have been experimenting and trying to get a suitable filter of the kind, and able to be packed on a horse or mule for use in hilly country. The earlier attempts to solve this difficulty were most unsatisfactory, the chief stumbling-blocks being size and weight. In November last, I suggested to the makers of these apparatus a design which they have put into practical shape, with the result that we are now in possession of a field service filter at once compact, handy, portable, efficient, and capable of delivering as much as sixty gallons an hour of sterile water. We are experimenting with a new type of filter tube, and when these are substituted for those now fitted in this apparatus, the delivery should be near eighty gallons an hour.

In principle, the filter is similar to those fitted to the water tanks. Fig. 1 shows a pair of these filters on a pack-horse, with a boiling kettle in addition, carried for the sterilisation of the filter tubes. Each filter, complete and dry, weighs 68 lbs., if wet it weighs 71 lbs. It is mounted on a basket-work platform, the frame of which is steel bicycle tubing. The apparatus consists of a semi-rotatory pump with 15 feet of tubing attached; the water raised by the pump passes into the central cylinder, which, packed with sponges under pressure, acts as a clarifier for the removal of coarse dirt. From this clarifying chamber the water passes to two filters placed one on either side and issues in a steady stream from the nozzles at the anterior end. We have subjected this filter to a variety of trials, and when using the muddiest water it has been possible to make or find, have not found the delivery to fall below fifty-four gallons in the hour; when using less muddy water the delivery has been sixty gallons in the hour. Fig. 2 shows one of these filters ready for use, while fig. 3 shows the same filter with one of the filtering cylinders open and the filter tube taken out for examination; it also shows the interior of the basket cover, with two spare filter tubes fitted therein as spare parts.

A feature of this filter is its compactness and lightness; this

latter has been secured by employing aluminium wherever possible. This has been done without sacrificing strength or rigidity. Another good feature of this filter is the fact that all detachable

FIG. 1.

parts are attached by small chains, so that no nuts, screw caps, handle pieces or nozzles can be lost, unless wantonly and forcibly broken away. The filter tubes are of the standard service pattern,

and interchangeable with those employed in the filter water tanks. Each tube is similarly covered with asbestos cloth for further protection against mud or other sediment which may have passed the sponges.

When not required for use, the hosing is detached and a screw cap placed over the aperture leading to the pump to exclude dust.

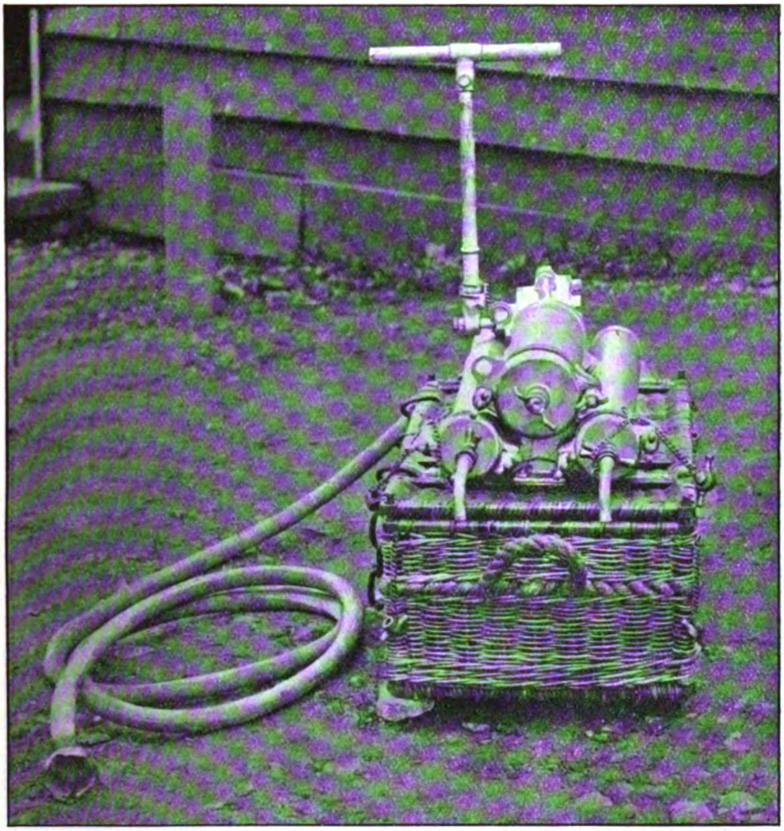

FIG. 2.

The pump handle is unscrewed as well as the T piece; this latter is strapped into the basket cover and the handle itself slid into the two eye-holes which are to be seen on the right side of the sponge chamber, and screwed home. The two nozzles are similarly detached and slipped into recesses provided for them under the filter cylinders; these slots are difficult to see in the photograph.

Screw-nuts are now adjusted over the delivery apertures to exclude dust. The whole apparatus is now ready to be packed up. This is done by lifting the filter platform up off the basket, the tubing is then coiled and placed in the bottom of the basket, and then the filter platform turned upside down so that the filter itself is inside the basket cover. The whole is now securely clamped down by means of small winged nuts which screw on to each of the four

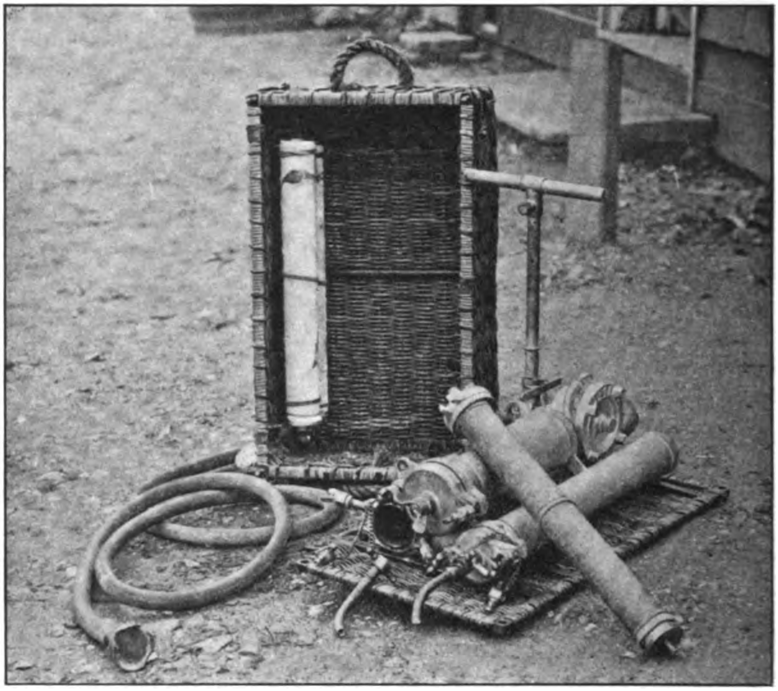

Fig. 3.

corners. The whole apparatus is now ready for attachment to the pack saddle. This is readily done by means of two short chains which are fixed to the upper inner border of the packed basket and which slip over the hooks on the saddle. A pair of these filters travel easily and well, requiring no ropes or straps to secure them. In spite of muddy water and large delivery, it is remarkable how easy this pump works. This is attributable to the firmness of the base on which the whole filter rests, and also to the increased power given to the stroke by means of the T piece. Each filter when

packed up ready for transport, makes a package measuring 25 by 15 by 9 inches and weighing seventy pounds.

In cases where wheel transport is impossible and where the ordinary filter water-tank cannot go, these pack-saddle filters will meet the requirements of troops. Four of these filters, that is, two mules or pack-horses, will suffice for an infantry battalion or a brigade of artillery, while a single mule or a pair of filters will be ample for a cavalry regiment. To work each filter one man is necessary; this means that a water squad of one corporal and four men of our Corps will have charge of and be the *personnel* for a pair of pack-animals carrying four of these filters. When one recalls the old tripod company filter and the many drawbacks associated with its use, the advantages attaching to this modern development will be obvious. Moreover, men who can work and take charge of a filter-tank will be equally fitted to work and control these more portable types. During the coming training season we propose to subject these pack-animal filters to practical work with troops, and anticipate no difficulties as to either efficiency or portability.

REVIEW OF THE PROGRESS OF HYGIENE, 1906.

BY LIEUTENANT-COLONEL A. M. DAVIES.
Royal Army Medical Corps.

I.—AIR AND VENTILATION.

Bacterial Tests for Air Contamination.—Dr. M. H. Gordon has added to his former valuable contributions on this subject. In a previous Report[1] he had shown that the fact that certain streptococci are normally present in the saliva (10,000,000 per c.c.) was applicable to the detection of droplets of saliva in air, in much the same way that *Bacillus coli* is used for the detection of fæcal matter in water, air pollution (and possible access of morbific virus) being thus capable of measurement as well as water pollution. Subsequently Dr. Gordon investigated[2] the characters of certain staphylococci with a view of ascertaining if it would be possible to detect the presence of particles derived from the skin as well as droplets of saliva. In the latest Report of the Medical Officer to the Local Government Board (for 1904-05, Appendix B. 5), this investigation has been continued. It appears that although a variety of staphylococci occur on the skin, one sort, having easily distinguishable characters, is found much more frequently than any other. "This frequents the epidermis of the hand, cheek, scalp and forearm with such persistency that it may be considered characteristic thereof in much the same way that *B. coli* is characteristic of the large intestine, and *Streptococcus brevis* of the mouth." This organism is the one named by Welch *Staphylococcus epidermidis albus*. Nine differential tests are available, viz.: Liquefaction of gelatine, 12 per cent. (a week at 22° C.); clotting of milk (a week at 37° C.); nitrate reduced to nitrite (3 days at 37°); neutral red changed (2 days anaerobically at 37°); acid production in slightly alkaline lemco litmus broth with 1 per cent. maltose (a week anaerobically at 37°); ditto with lactose, and with glycerine. Acid formation does not occur with mannite, nor is milk peptonised by this staphylococcus. Another form, reducing nitrate and acidifying mannite, but negative in regard to the other tests, was found frequently in the scurf of the scalp.

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[1] Report of Medical Officer to Local Government Board, 1902-3, App. B. 2.
[2] *Ibid.*, 1903-04, App. B. 4.

Gordon obtained fifteen kinds of staphylococci from the open air, but none presenting the characters of the two just mentioned. In indoor air, on the other hand, as of a barber's shop and of an operating theatre, on each of three occasions this particular staphylococcus was recovered, showing that it is applicable as a test for particles of integument in the air.

In a Parliamentary Blue Book (Appendix to Report of Committee on Ventilation of the House of Commons, 1906), Gordon details some elaborate experiments showing the presence and distribution of impurities (*i.e.*, micro-organisms), derived from the mouth, throat and air passages, in the air of a chamber when speaking is in progress. The test was the identification in various situations of *Streptococcus brevis*, which is constantly found in, and can reveal the presence of even one ten-millionth of a cubic centimetre of, saliva. Droplets of saliva are to be found in the air of all rooms when speaking is going on, and are wafted about by air currents to considerable distances. The chief particulate pollution detected in the air passing out of the debating chamber was found to consist of such droplets, extremely minute, but apparently constantly present in the air during debates, and not found therein when the debating chamber is empty. To determine to what distance, and in what directions, salivary droplets are propagated during speaking, *B. prodigiosus* was used, the mouth of the person speaking being infected with this easily recognisable organism just before commencing. Portions of "King Henry V." and "Julius Cæsar" were then recited in a loud voice. By this test it was fairly well shown that, even when the ventilation arrangements were at work, the air of the chamber became generally infected, especially in the galleries, with salivary droplets from the mouth and respiratory passages of the person speaking. The ventilation dispersed, but did not carry off, the particulate matter derived from the breath; for of a number of agar plates exposed in various situations, 25 per cent. were found to be infected on the benches on the floor of the house, and 50 per cent. of those exposed in the galleries.

The mode of spread of infectious diseases, such as influenza, tubercle, &c., in crowded places, especially when talking is going on, has thus been demonstrated, in confirmation and amplification of the observations of Koch and Flugge, and especially of Heymann (1901). It remains to be seen whether any ventilation measures that are practically available will afford adequate protection.

II.—Water and Water Supply.

Bacteriological Examination of Water.—Dr. Houston contributes another of his very valuable reports to the Supplement, containing the Report of the Medical Officer to the Local Government Board (1904-05, Appendix B. 2). In this he deals with the examination (1) of deep well waters at Tunbridge Wells; (2) waters in two Highland lochs.

(1) The Tunbridge Wells water is derived from the Ashdown Sands by a series of bore wells sunk to a depth of 350 feet; the sands are overlaid by the Wadhurst Clay, the depth of which is about 200 feet. This water, as might be expected, is of a high degree of bacteriological purity. Of 49 samples examined none contained typical *B. coli* in 100 cc.; of 27 of these samples as large a quantity as 1,000 cc. was tested, and in 26 no typical *B. coli* was found. Of 31 samples, none contained gas-forming coli-like microbes of any kind in 100 cc.; of 25 samples, in which 1,000 cc. were examined, 20 contained no coliform microbes of any kind. Deep well water properly protected is, therefore, practically free from typical *B. coli*, and, as a rule, from atypical coliform bacilli. None of the samples yielded *B. enteritidis sporogenes* in 10 cc.

(2) Two large Highland lochs, in parts very deep, were examined. Both contain trout in large numbers, and are liable to some degree of animal excretal pollution. Loch Laggan is exposed also to some degree of human excretal pollution from the Pattack stream, which also receives the drainage of manured land. Still, the volume of water in each loch is so enormous that it was anticipated that the bacteriological tests would be satisfactory. Loch Laggan is about nine, and Loch Ericht about fifteen, miles long; the breadth of each is half a mile or more.

Twenty-six samples from the burns feeding Loch Laggan were examined: *B. coli* or coliform bacilli were found in all samples; in 2 it was found in as little as 0·1 cc., in 14 others in 1 cc., in the remaining 10 samples it was found in 10 cc. or 100 cc. *B. e. sporogenes* was found in 3 out of the 26 samples in 10 cc. Of the Loch Laggan water itself 85 samples were examined: in 1 sample coliform bacilli were found in as little as 1 cc., in 28 samples they were found in 10 cc., and in 42 samples in 100 cc., while in 14 samples none were detected even in 100 cc.; of these coli-like organisms 82 per cent. gave the "flaginac" reactions. *B. e. sporogenes* was found, or suspected, in 4 only of the 85 samples. Houston considers that the *B. coli* found in the burn and loch

samples were largely not of human origin, but were derived from the drainage of manured land and from animal excreta.

Loch Ericht is very deep; it appears to be practically free from any source of pollution of human origin: 100 samples were examined, in 1 sample only was a coliform organism found in 10 cc., in 19 it was found in 100 cc., the remaining 80 contained none, even in 100 cc. Only 6 out of 21 specimens (28·6 per cent.) were "flaginac" *B. coli*. One sample only yielded *B. e. sporogenes* in 10 cc. As 80 per cent. of the Loch Ericht samples contained no *B. coli* or coliform bacilli even in 100 cc., although trout were very numerous in this loch, it does not appear that the presence of fish is likely to interfere to any appreciable extent with the significance or utility of the *B. coli* test, as regards undesirable (*i.e.*, human) pollution.

These researches are interesting and important, as establishing the purity of deep well and unpolluted lake waters from a bacteriological standpoint; they show that coliform bacilli are not omnipresent, and they provide a justification for somewhat stricter standards of purity for drinking water than are by some authorities considered sufficient.

III.—Food and Dieting.

Recent Work on Dietetics.—Some allusion was made last year in this Journal (vol. vi., p. 226) to the recent experimental work of Chittenden, of the Yale University, on minimum proteid requirements for healthy men. During the past twelve months considerable attention has been given to this subject, and Chittenden's results, or rather the deductions that he drew from them, have been severely criticised. What may be termed the orthodox, or accepted, standards of alimentation for average individuals doing ordinary work, have been stated as follows:—

	Proteids	Fats	Carbohydrates	Calories
Voit ..	118 ..	56 ..	500 ..	3,000
Rubner ..	127 ..	52 ..	509 ..	3,092
Atwater ..	125 ..	125 ..	400 ..	3,315

It is admitted that figures such as these (except Atwater's) have been arrived at empirically, by experience or observation as to what amounts of food large bodies of persons under different conditions of life have been in the habit of taking. It has been assumed that the generalisation was sufficiently extended to warrant the opinion that the quantities of the different food principles that were actually taken were those that were really required physiologically,

not merely such as were to the mass of the population agreeable. Chittenden, distrusting this argument, set himself first of all to find what was his own proteid requirement; he determined this to be from 36 to 40 grammes daily while doing ordinary work, *i.e.*, considerably less than half the usually accepted amount of proteid. The metabolised nitrogen was 5·7 grammes, or 0·1 gramme per kilo. body weight daily.

He then proceeded to determine the proteid requirements of three groups of individuals successively. The first group consisted of five professional men—University professors—who maintained a condition of good health for six to nine months on a dietary with an average metabolism of from 34 to 56 grammes proteid per day, being at the rate of 0·1 gramme nitrogen per kilo. body-weight daily, or but little in excess of this. The second group consisted of eleven soldiers of the United States Army: for five months a metabolism of less than 50 grammes proteid per day was found to be sufficient to keep them in good health, the metabolised nitrogen varying between 0·1 and 0·15 gramme per kilo. body-weight. A third group of eight University athletes subsisted for five months in health, and taking active exercise, with an average daily metabolism of 55 grammes proteid, the metabolised nitrogen being at the rate of 0·1 to 0·13 gramme per kilo. body-weight daily.

These observations are remarkably harmonious; they were continued for many months; in practically every case the individuals living on this greatly-reduced nitrogenous diet not only maintained, but improved, their health and capacity for work, as also their feeling of *bien être* and freedom from fatigue. It is not to be wondered at that this research was received as a most weighty contribution to the study of dietetics, as, indeed, it was the most laborious, long-continued and exact of any investigations of the kind hitherto made.

At the Toronto meeting of the British Medical Association last August Chittenden's results were somewhat adversely criticised by Halliburton and R. Hutchison, the former urging the danger of living too near a minimum, and the latter suggesting that it might be well to have some excess of proteid in the circulation as affording a higher power of resistance to disease; pointing out also that Nature provides two lungs and two kidneys, though life may be maintained with only one; the two can hardly be superfluous, and emergencies ought to be provided for. Folin admitted the soundness of Chittenden's conclusions as to the minimum amount of proteid that was necessary, though regarding the optimum require-

ments as probably lying somewhere between the orthodox figure and that put forward by Chittenden.

The most detailed criticism of Chittenden's position has been that of Professor Benedict, of the Wesleyan University, Connecticut (*American Journal of Physiology*, August, 1906). Having collected the dietaries actually in use from a large number of sources (chiefly American), he maintains that they show two things: (1) everywhere people, who can obtain such food as they desire, use liberal rather than small quantities; (2) the more severe the work done, the larger the quantity of food eaten. Having regard principally to the nitrogenous constituents, he finds that persons doing light work take 100 grammes proteid daily; those doing ordinary work take 115 grammes; while those engaged in very active muscular exertion take 175 grammes daily. It is now commonly agreed that increased muscular work does not materially increase the disintegration of muscular tissue. Why, then, is there always found an increased proteid consumption with increased muscular exercise? And why do people in general consume more proteid than is required to repair waste tissue? It is very significant that this is quite universal, as far as statistics afford evidence: England, France, Germany, Italy and Russia, as well as (contrary to popular impression) Japanese[1] and Chinese dietaries, show an agreement in respect to a liberal quantity of proteid demanded, in spite of variation in nationality, climate, geographical conditions and dietetic habits.

Benedict admits, of course, the accuracy of Chittenden's observations; but doubts if he has incontrovertibly proved that the restricted nitrogen diet can be maintained permanently; the improvement in health that occurred in all the subjects may, he thinks, have been due to the simple, regulated mode of life, not necessarily to the small amount of proteid consumed. He points out a peculiarity in regard to the digestive phenomena of the group of eleven soldiers. These men all consumed practically identical quantities of food, during three periods of six, seven and five days; one would expect that with eleven normal alimentary tracts the quantities digested would be very much alike, and the quantities of nitrogen excreted through the fæces also almost the same. This had indeed been the case in some experiments he had himself conducted on cheese digestion (at the Wesleyan University) with

[1] The present dietary of the Japanese Navy supplies 155 grammes protein, which, considering the body-weight, is above the average.

twenty-five or thirty men: of 40 grammes nitrogen ingested during a three-day experiment, 4·7 grammes were on an average recovered in the fæces, with but two or three decigrammes variation. But in Chittenden's series, with a total nitrogen ingestion of 49·4 grammes, the nitrogen in the fæces ranged between 4·45 and 12·10 grammes, with marked variations from the average (8·46 grammes) in a majority of the cases. Similar large variations were found during the other two experimental periods. These large variations in digestibility of the same diet are much more marked than in the ordinary healthy individual; it may have been that there was some disturbance of the alimentary tract, affecting its power of absorbing either the protein of the food, or the nitrogenous materials from which the so-called metabolic products are derived—a disturbance due to the abnormally low protein intake.

With regard to the eight athletes, Benedict considers it significant that the reduced diet had not apparently been persevered with, although one would suppose that if the improved bodily condition had continued, the dietetic alterations would have been eagerly adopted in the efforts towards increased athletic success.

Referring to the experiments on animals, Benedict notes that (1) for carnivora, Munk, Rosenheim and Jagerroos have shown how in dogs a low protein diet resulted in loss of absorptive power in the intestinal tract, due apparently to change in condition of the epithelial cells and diminished secretion of digestive fluids; (2) for omnivora, Shutt, of Ottawa, and afterwards Skinner, of Indiana, have recorded that in hogs fed on low protein diet the muscular tissue becomes of very poor quality, being known as "soft" pork; improvement taking place when nitrogenous material is added to the food; (3) for herbivora, Haecker, in Minnesota, fed two groups of cows, one on normal protein diet, the other on a much lower amount; after two years both groups appeared to be in the same condition, but during the third winter the cows on the low protein began to fail, and this constituent had to be increased. This slowness in the appearance of deterioration is very significant. It may also be the case in man.

Benedict concludes, therefore, (1) that from the experiments on soldiers it is seen that abnormally low protein may affect nitrogenous absorption in the alimentary tract; (2) animals fed on low protein do not thrive so well as on liberal quantities; (3) dietary studies all over the world show that in communities where productive power, enterprise and civilisation are at their highest, man has instinctively and independently selected liberal rather than

small quantities of protein. He particularly instances the immense improvement that takes place, both in physique and morale, in the negro and poor white of the Southern States, and in the Italian labourer of Southern Italy, when fed on a higher protein dietary.

It must be allowed that there are two sides to this question, and that there is much to be said on each. Of the practical importance of the matter there can be no doubt. The current ideas as to what constitutes a minimum adequate allowance of food are generally derived from the older, or orthodox, standards which, *inter alia*, lay down 100 or 130 grammes of proteid as a daily necessity for an individual doing ordinary work. Mr. Seebohm Rowntree, indeed, in his study of *Poverty*, adopting the estimates of Atwater, took 125 grammes proteid and 3,500 calories as the minimum daily requirement; and based his conclusions (as to prevalence of poverty) on the cost of a ration yielding 137 grammes proteid and 3,560 calories daily. But if it be true that 50 or 60 grammes of proteid are sufficient, then the cost of the dietary necessary for a man doing ordinary work will be very considerably reduced, and consequently there will not be such a large number of persons unable to purchase the minimum dietary required; in other words, the amount of poverty existing in our population will be less than Mr. Rowntree estimated. The amount of ignorance as to food values prevailing amongst our poorer classes is, however, so great, that probably very large numbers are suffering from semi-starvation owing to want of knowledge, rather than want of means.

Tinned Meat.—Much interest was excited, not only amongst those concerned with the public health, but throughout the community generally, by the publication in the early part of 1906 of Mr. Upton Sinclair's book, "The Jungle," which, under the guise of a novel of incident, purported to disclose a state of things obtaining in the vast food industry of the United States (especially at Chicago) that caused uncomfortable feelings in both hemispheres. The matter could not be dismissed as a tale, full of sound and fury, signifying nothing; for the President of the United States, in a message to Congress on June 4 (accompanying a report by the Government Commissioners on the slaughter-houses and packing establishments of Chicago), stated that it was urgently necessary to provide immediately drastic and thorough-going inspection of all stock-yards, packing-houses, and their products, so far as these last enter into inter-State or foreign commerce. There appears to be no doubt that the conditions under which animals were slaughtered, and tinned or canned foods prepared, were in many cases filthy and

disgusting, and that grave danger to health must necessarily result to the consumers of such foods. This danger would exist owing to (1) possibility of food poisoning from the filthy conditions under which the canning has been in many cases carried on; and (2) possibility of transmission of disease, owing to the use of the flesh of diseased animals (*e.g.*, tuberculosis).

It has been doubted whether the insanitary enormities that were reported referred to food intended for consumption in the United States only, or whether food exported to this country might also be reasonably suspected. The opinion of an experienced provision merchant of Liverpool, well acquainted with the conditions of the trade, and with personal knowledge as to the state of things at Chicago, was quoted in the *Times* (June 1st, 1906), to the effect that the sanitary state of the packing houses was most disgusting; that, though bacon and hams and tongues were fairly innocent, any foods in the shape of brawn, or potted meats, were prepared under conditions that were indescribable, and that the alleged food inspection was of no effect.

The consumption of these foods is so extensive in this country, and their use for ourselves is so widespread under Field Service conditions, that the matter is one of great interest and importance to the Army Medical Officer. Although a very great quantity of tinned meat was condemned as unfit for food during the South African War, it is certain that the greater part became unfit owing to the tins suffering damage by rough usage or exposure, and that the meat itself had been of apparently good quality when put up in the tins. The general opinion will certainly be that the tinned meat that is ordinarily purchased or consumed in this country, even though of Chicago origin, is not obviously of bad quality. It is none the less necessary to guard against possible disease transmission (as of tubercle, or of animal parasites), and possible food poisoning (through ptomaines or toxins). There seems to be some doubt whether the American Pure Food Law, passed in February, 1906, or the subsequent legislation of that year will afford sufficient protection. Very rigorous inspection at our ports of entry is required, and is now being carried out. Public authorities are exercising increased vigilance in this matter throughout the country.

Dr. George Newman has emphasised the importance of *inspection at the time of manufacture* as being the only effective method (*Public Health,* November, 1906). This is, no doubt, the case as far as regards food prepared within our own shores, but in the case

of imported foods we must rely on inspection at the port of entry, and when the article is exposed for sale. Dr. Newman's requirements are: (1) the manufacturer's name and place and date of canning to be impressed on the can: (2) food intended for canning to be inspected at the factory, and to be derived from animals that have already been inspected; (3) premises and apparatus used in preparation processes, or for storage, to be regularly inspected, and kept in good sanitary condition; (4) imported canned goods should have a certificate that they have been produced and prepared under administrative control and inspection; (5) the "detective" system of inspection, as now practised, should be much more thorough.

For Army Medical Officers the existing instructions as to examination of tinned or canned foods (*Supply Handbook*, p. 31) are practically sufficient. It will be found that the most convenient way of testing for presence of gas in the tin is to place a good sized drop of water on one end of the tin and to puncture the tin *sharply* through this drop; if there is a partial vacuum in the interior, the water will be sucked in: if there is formation of gas, bubbles will escape, forming a froth with the water.

Another practical point is this: if there is a faint suspicion of a tympanitic note on tapping a tin, a suspicion not strong enough to warrant condemnation, set aside the tin in a warm place for twenty-four hours, and test again by tapping; if gas formation is going on, the tympanitic note will be more marked. Many firms now date their tins, therefore this stamp should always be looked for.

"Non-bacterial blowing" of tins has been described by Pfuhl and Wintgen as due to insufficiency of the tin lining, the acid of the food material acting electrolytically on the iron case and producing gas, which consists partly of hydrogen, partly of atmospheric air. The same action has been described as occurring in tinned milk, by Dodge, of New York.

Food Preservatives.—Much activity has been shown by public authorities during the past year in various parts of the country as regards inspection of preserved foods, and many prosecutions have been undertaken when the amount of preservative added has been found to be excessive. The Metropolitan Branch of the Society of Medical Officers of Health went so far as to pass a resolution in July, that "the use of preservatives in canned food is unnecessary, and should under no circumstances be permitted." The Corporation of the City of London, in October, communicated to the Local Government Board their opinion that the time had now arrived

for adopting the recommendations of the Preservatives Committee appointed by the Board of Agriculture; these recommendations had been made in 1901, but have hitherto had no legislative sanction. In regard to milk the Local Government Board in July addressed a circular to local authorities, suggesting that they should take action under the Sale of Food and Drugs Act in instances where preservatives were reported to be present: in cases where the vendor makes a declaration, by label or otherwise (in reference to Section 6 of the Act of 1875), that he does not sell the "milk" as such, or that its quality in regard to preservatives is not guaranteed, or that it contains some added preservative, the Local Government Board consider that formalin 1 in 40,000 (= formic aldehyde, 1 in 100,000) parts, or boric acid 57 parts per 100,000, when found to be present in a milk sample (within three days of its collection) raises a strong presumption that the article has been rendered injurious to health and the purchaser prejudiced.

The preservative most largely in use for meat foods is probably boric acid, in accordance with the present taste for "mild cured" foods; this is added instead of the old-fashioned saltpetre; it appears that large quantities of foods, such as hams, are imported packed in boric acid for transit purposes, and that potted meats prepared from such hams, &c., may contain notable amounts of boric acid without any having been added by the manufacturers in this country; 0·25 per cent. (17½ grains per lb). is said to be sufficient when used for packing; amounts that have been actually found are 145 and 163 grains per lb. (20·3 and 22·8 per cent.). In such cases prosecution might be undertaken effectively.

Food Poisoning.—There is still much to be learned as to the nature and exact causation of food poisoning by bacterial agency. Dr. W. G. Willoughby (*Public Health*, August, 1906), describes an outbreak at Eastbourne, affecting sixty persons, the symptoms being those of high fever and acute enteritis, but without any fatal result. The cause was distinctly traced to some brawn, which apparently had no peculiarity of taste or appearance; the severity of the symptoms varied with the quantity consumed; there was a short incubation period. The brawn came from Nottingham, and it was ascertained that similar cases of poisoning had occurred in that town at the same time, from the same consignment of brawn. It was evident, therefore, that the brawn became poisonous not at Eastbourne but before it left Nottingham. Chemical and bacteriological examinations were made by Mr. M. Wynter Blyth, who found coliform organisms of various kinds to be present, amongst

them being some true *B. coli;* the organisms were found to be far more numerous on the outside than in the interior. *B. sporogenes* was also found in one specimen. The conclusion was that the brawn had been prepared from sound meat, and had afterwards become infected, probably with intestinal organisms, on the surface, these bacteria subsequently growing inwards. Neither ptomaines nor poisonous albuminoids could be definitely demonstrated.

Levy and Fournet relate a small outbreak of food poisoning (*Cf. Bakteriologie,* Orig. xli.) following on the consumption of damaged food. Seven members of one family were attacked suddenly with vomiting, diarrhœa and fever; in four of these cases there was enlarged spleen, in one a characteristic typhoid roseola. The symptoms improved on the third or fourth day, except in one case, where they were like those of genuine typhoid fever, lasting eighteen days. Bacteriological examination showed the presence of paratyphoid bacillus B. in the excreta of all the persons; all their serums agglutinated with paratyphoid B.; from one case it was isolated and proved very virulent to a guinea-pig, and fatal to mice.

A somewhat similar outbreak was traced by Lobenau (*ibid.*, xl.) to eating cutlets *avariées* (damaged) at a large sanatorium; the symptoms were diarrhœa, vomiting, abdominal pain and headache, coming on eleven hours after eating; in some cases there was fever for two or three weeks. By exclusion, the cutlets were incriminated; a short spore-bearing bacillus was found, pathogenic to dogs, guinea-pigs and mice being refractory. The meat had been kept on ice, then boiled, then put on ice again,—in July.

IV.—Removal and Disposal of Sewage.

Biological Treatment of Sewage.—Some further evidence has been adduced in regard to the efficacy of fine-grain percolating filters by Dr. G. Reid. This relates in particular to the high degree of purification effected in the upper layers, and if found to hold good generally with the materials in ordinary use, a considerable increase in the adoption of this method may be looked for. Hitherto it has been considered that the greater the depth of the filter (within limits) the greater the degree of purification obtained. In the Hanley filters, however, it has been found that the effective purification takes place in the upper three feet.

	Parts per 100,000					
	Solids in suspension	Free ammonia	Albuminoid ammonia	Oxygen absorbed		Nitric nitrogen
				4 hours	3 minutes	
Sewage	63·5	2·154	0·972	5·019	1·862	0·02
Septic tank effluent	7·6	1·716	0·340	2·184	0·836	*Nil.*
Filter, 1 ft. depth..	0·25	0·036	0·052	0·328	0·093	1·64
„ 3 „ ..	0·14	0·009	0·031	0·244	0·060	1·75
„ 4½ „ ..	—	0·043	0·027	0·259	0·070	1·70

The quality of the filtrate at 3 feet is seen to be as good as, or better than, that at 4½ feet depth. The filtering medium is broken "saggers" (pottery chips), and the best results have been found to be given by a fine grade, ⅛ inch fragments. The distribution is effected by travelling sprinklers, giving 200 gallons per day, in 200 doses of 1 gallon each, per square yard of filter surface. It is seen that the suspended solids are practically all retained in the top layer of the filter, where the organic matter is liquefied. The upper few inches may require to be removed and washed, but so far this has not been found to be necessary, after three years' working.

If a similar successful result is obtained with fine grade material of different sorts, and with sewage of different characters, the reduction in depth necessary to produce satisfactory purification will be of great importance, especially in places where the available fall is limited.

V.—Causation and Prevention of Disease.

Plague.—A *Report* on plague investigations has been issued by the Committee appointed by the Secretary of State for India, the Royal Society and the Lister Institute (*Journal of Hygiene*, September, 1906), in which the fact of transmission of the disease from animal to animal by means of fleas has been proved to demonstration.

(1) On thirty occasions it was found that a healthy rat contracted plague, after living in the neighbourhood of a plague-infected rat, but under circumstances which prevented the healthy animal from coming in contact with either the body or the excreta of the infected rat; fleas were abundant, and could pass freely between the two rats. (2) In twenty-one out of twenty-eight experiments, healthy rats living in flea-proof cages contracted plague after receiving fleas (*P. cheopis*) collected from rats dead or dying of plague in another cage. (3) By observations on guinea pigs it was found that close contact between infected and healthy animals, if fleas were excluded, did not give rise to an epizoötic; this contact

included contact with the fæces and urine of infected animals, and eating food contaminated by the same. Close contact of the young, even when suckled by plague-infected mothers, did not transmit the disease. (4) If fleas were present, the epizoötic, once started, spread from animal to animal, the rate of progress being in direct proportion to the number of fleas present. (5) Guinea-pigs, allowed to run free in infected houses, acted as good traps for fleas, on an average twenty per room being obtained, mostly rat fleas; in 29 per cent. of the rooms tested guinea-pigs contracted plague. (6) In plague houses disinfected by the ordinary means, numbers of fleas were found to be still present; guinea-pigs allowed to run free became infected in 29 per cent. of these houses. (7) In forty-two experiments, two guinea pigs, one protected from fleas by a wire gauze curtain, the other not so protected, were placed side by side in a plague house. Both animals were protected from soil infection and from contact with other animals, but were equally subject to aërial infection. None of the protected ones, but four of those unprotected, contracted plague. (8) Animals protected from fleas by a sufficiently broad layer of "tangle foot" (a sticky, resinous preparation used for catching flies) and placed in plague houses did not contract the disease, while several animals, similarly placed, but not so protected, did take plague.

Contrary to the experience of Hankin in 1898, the Commission found that in making passages of *B. pestis* from rat to rat, without intervening culture on artificial media, no diminution of virulence occurred; the time taken in this experiment was eighty-nine days.

With regard to the important point of the infectivity of the ground, floors of cowdung grossly contaminated with *B. pestis* were found to remain infective for forty-eight hours, when scrapings were rubbed into susceptible animals; and for twelve hours (not for twenty-four) to animals running about freely over them; *chunam* floors similarly contaminated remained infective for twenty-four hours by rubbing scrapings, and for six (but not for twelve) hours, to animals running over them.

Diphtheria.—The significance of the various pseudo-diphtheritic bacilli, especially of the Hoffman bacillus, continues to be discussed. Dr. Joseph Priestley (*Public Health*, February, 1906), has related in detail the circumstances of an outbreak of diphtheria and Vincent's angina, in connexion with which Klebs-Loeffler and Hoffman's bacilli and Vincent's organisms were found together. This occurred in July, 1905, in a Lambeth institution, the inmates of which con-

sisted of about 600 children and officers, and was characterised by the extreme mildness of many of the cases, clinical symptoms (except slight redness, with minute ulcerations of the nose or fauces) being absent, and the diagnosis depending solely upon bacteriological examinations.

The outbreak was traced to two chief sources, the Infirmary and the Receiving Ward; of the total number of sixty-four cases the Infirmary was found to be responsible for the causation of thirty-six. A child, J. J. T., was an inmate of the Infirmary from April 13th to 28th, suffering from stomatitis and catarrh; he occupied a bed next to another child, W. J., whose throat showed, on examination, modified diphtheria bacilli, and a few doubtful Vincent's organisms; the rest of the J. family were traced (three being at the institution and three at the workhouse), and four of them were found to harbour modified diphtheria bacilli in their throats, one had a pure cultivation of Klebs-Loeffler and one only (the father) gave a negative result. The child, J. J. T., returned from the infirmary to his own block on April 28th, having his throat infected, but presenting no clinical symptoms of any kind. Contrary to the standing recommendation of the medical officer, the child was transferred *direct* from the infirmary to his block without passing through a convalescent or probation ward. Out of the sixty-six inmates of this block thirty in all were removed to the Metropolitan Asylums Board Hospital suffering from actual or potential diphtheria (complicated in five instances with Vincent's angina) as shown by the presence of Klebs-Loeffler and Vincent's organisms in their throats or noses; nine others showed Hoffman's bacilli in their throats or noses; and one other (the child J. J. T. just mentioned) showed modified Klebs-Loeffler and pseudo-diphtheria bacilli, together with a few doubtful Vincent's organisms, pointing to a recent attack of diphtheria complicated with ulcerative stomatitis.

The Receiving Ward was responsible for seventeen cases. On June 16 a child, B. A., was admitted to the Receiving Ward from the Lambeth Workhouse, stated to be suffering from enlarged and inflamed tonsils; the throat was examined, and a pure cultivation of Klebs-Loeffler bacillus obtained. The child was next day removed to the Metropolitan Asylums Board Hospital, but had been twenty-four hours in contact with forty other children in the same ward, whose throats were at the time infected with pure, or modified, Hoffman bacilli and modified Klebs-Loeffler bacilli. The result was an explosive outbreak, during the following four to

fourteen days, of pure diphtheria; nine children directly, followed by seven others indirectly; the child B. A. having been the match which caused the explosion. It was afterwards found that this child had also caused a localised outbreak of eleven cases at the workhouse. Of the total of sixty-four cases, fifty-three have been accounted for; of the remaining eleven the source of infection could not be so definitely traced.

The preventive measures adopted were, shortly, careful medical inspection of all contacts and suspects, including bacterial examinations of noses and throats, and followed by strict isolation of all persons showing the presence of either Klebs-Loeffler bacilli or Hoffman bacilli (pure or modified). No patient should be deemed free from infection until after three successive negative examinations of both nose and throat.

Dr. Priestley draws attention to the following points: (1) Mildness and nature (nasal) of the type of diphtheria (latent forms); (2) importance of convalescents from infirmaries passing through a probation or convalescent ward; (3) the power that the true Klebs-Loeffler bacillus appears to have of losing its virulence, lying dormant, and afterwards regaining it under suitable environment; (4) variation in virulence and in morphology of diphtheria organisms; (5) the need for strictly isolating all "carrier" or potential cases, *i.e.*, persons, especially children, who do not show any clinical symptoms, but who have in their throat or nose, or both, the germs of diphtheria. This is in accordance with previous experience at Colchester, Cambridge, and elsewhere, but is, of course, difficult and troublesome in practice. The clear, detailed account by Dr. Priestley demonstrates that the trouble must be taken and the difficulties overcome if the disease is to be combated with success.

In order that there may be no doubt as to the nature of the organisms found, their morphological and staining characteristics are here given:

(1) *True Klebs-Loeffler Bacilli.*—Slender rods, 3 to 5 $\mu \times 1 \mu$, non-motile, non-sporing, staining with methylene blue (segmental and polar), and typically by Gram and Neisser methods, having a tendency to arrange themselves in parallel groupings; giving acid reaction with glucose; virulent to animals. *Involuted* or *modified* forms: spindle- and club-shaped rods, staining irregularly with methylene blue, and only occasionally typically with Gram and Neisser; non-virulent to animals.

(2) *Hoffman (pseudo-diphtheria) bacilli.*—Short even rods, 1 to 2 μ long, staining evenly with methylene blue, not at all typically with Gram

and Neisser, giving no acid with glucose, non-virulent to animals. The grouping of these bacilli at times seemed to point to a sort of connexion or correlation with the Klebs-Loeffler bacilli, antecedently or subsequently.

(3) *Vincent's Organisms.*—(*a*) Fusiform, elongated bacilli, 6 to 12 $\mu \times$ 1 to 1·5 μ, vacuolated, motile or non-motile, not staining with Gram, staining irregularly with Ziehl's liquid, readily cultivated in ordinary broth or human serum; (*b*) fine long spirilla of varying lengths, sinuous and very motile, staining badly or not at all with the usual reagents, not cultivated in the ordinary well-known media. These organisms are found in Vincent's angina, an infectious disease, most frequent in children from 8 to 10 years, appearing rarely in a diphtheroid form, and commonly as a deep ulceration of the membranes of palate, tonsils, &c. Vincent holds that they may also cause ulcerative stomatitis.

Yellow Fever.—The main facts regarding the causation and prevention of this disease are now fairly well understood, though many points still await explanation. For practical purposes, however, prevention resolves itself into measures for the extermination of *Stegomyia fasciata*, and of protection both of the yellow fever patient and of the healthy population from its bite.

S. fasciata is a domestic mosquito, frequent in the crowded parts of cities, where it breeds in water cisterns and barrels, and in small collections of rain water, such as in gutters, empty tins, bottles, &c., also in cesspools. Professor R. Boyce summarises the preventive measures thus (*Transactions of Epidemiological Society*, xxv., 1906):—(*a*) In connexion with the patient and infected mosquito: (1) Early notification; (2) isolation; (3) screening with wire gauze (18 meshes to the inch), the whole room being preferably so treated, and the entrance protected by double doors (air-lock); (4) fumigation of the whole house, except the patient's room, which is screened: effective agents are sulphur (2 lbs. to 1,000 cubic feet), pyrethrum (3 lbs. to 1,000 cubic feet), in each case the duration of the process being three hours; or camphor and crystallised carbolic acid fused into a liquid with gentle heat, 4 oz. to each 1,000 cubic feet, the duration being two hours. (*b*) In connexion with extermination of *Stegomyia*: (1) Survey of cisterns, &c., to discover the mosquito; (2) screening and controlling of the water supply (the form of water receptacle being prescribed, and barrels and all open receptacles being prohibited); this screening of water supply is to be especially borne in mind in connexion with wharves and shipping; (3) mosquito nets and screening of houses; (4) anti-mosquito propaganda. Stamping out has been achieved with brilliant success at New Orleans in 1905.

Marchoux and Simond have carried out important researches at Rio Janeiro (*Annales Pasteur*, xx., 1906). They have proved the transmission of hereditary virulence in *Stegomyia:* a female having bitten a yellow fever patient, deposited its eggs; two females from this brood were made to bite a healthy individual, who thereupon became infected with the disease. This subject had not come into contact with any other source of infection. He was subsequently bitten by several mosquitoes which had fed on a fatal case of yellow fever in the second day of the illness; no inconvenience ensued, indicating that this individual was immunised. The experiment was repeated with mosquitoes which had bitten a severe case of yellow fever on the first day of the disease, and again with a negative result. Marchoux and Simond, however, do not think that "hereditary virulence" of mosquitoes can extend through many generations, or is of much epidemiological importance; possibly passage through the egg of *Stegomyia* brings about attenuation. They have not succeeded in infecting *S. fasciata* from cadavers of infected mosquitoes; nor have they found the excreta of patients to be capable of infecting mosquitoes; moreover, the females avoid the regions of the skin that are soiled by the excretions of the patients. They did, however, infect the mosquito by pounding living infected mosquitoes with glucose and *eau physiologique* and administering the mixture to *Stegomyia;* sixteen days later three of these bit a man, who subsequently had a typical attack of yellow fever; thus showing that the virus can pass from one mosquito to another.

S. fasciata is the only mosquito that transmits the virus, so far as is known. Among most mosquitoes the fact that the death of the female occurs after the first laying of eggs is against the possibility of their becoming infective: *S. fasciata* is an exception to this rule; the female can furnish seven successive broods after one copulation, provided fresh blood is ingested after each laying; in the free state the average is three broods. It is to this biological peculiarity that this mosquito owes its power of transmitting the yellow fever virus; the ingestion of living blood is necessary to it for the development of its eggs. In its early life it appears to bite both by day and night, but after the first laying it ceases to bite during the day; hence yellow fever transmission occurs normally during the night. Marchoux and Simond have succeeded in keeping alive and rearing *S. fasciata* in France; during the summer the temperature of the interior of dwellings is suitable, and it can multiply, although in a less active fashion than in tropical climates. This is of epidemiological significance.

Malarial fevers.—The results of the preventive measures that have been undertaken in the malarious districts of Italy are most encouraging. Besides measures of drainage and agricultural improvement, there have been two chief lines of attack on the disease—prophylactic administration of quinine, and mechanical protection against mosquitoes.

(1) *Quinine Prophylaxis*.—In the notorious Campagna of Rome, in 1900, when no medicinal prophylaxis was carried out, malaria prevailed to such an extent that 31 per cent. of the population suffered from attacks of fever; in 1901 quinine commenced to be given systematically, and in this year 26 per cent. were attacked. The figures for the three years succeeding were 20, 11 and 10 per cent. respectively; and in 1905 only 5·1 per cent. of the population suffered. Celli, in his summing up of the experiences of 1904, concluded that quinine administration during the pre-epidemic period was of no use (it.has now been abandoned). The continuous and daily treatment of relapses during the two most feverish months with 40 to 60 centigrammes of quinine gives good results. Out of a population of 70,000 persons, protected by routine quinine administration, only 8·08 per cent. suffered from malarial attacks; and this was in a bad fever year, and, of course, in malarious localities. In a particular district, in the lower valley of the Aniene and Tiber, amongst 578 persons treated regularly with quinine, there were 12·11 per cent. of cases; in 270 persons treated irregularly there were 50 per cent. of cases, and amongst the control population not treated at all, there were 46.52 per cent. of cases. Again, in 1905, in the same Aniene valley (which is notoriously feverish), out of 419 treated prophylactically, only 3·81 per cent. of cases occurred.

Celli, summing up for 1905, states that in North Italy malaria was not bad, but in the South it was very bad. The daily prophylaxis by 40 centigrammes of quinine, in 59,340 persons treated, resulted only in 5·8 per cent. suffering from malarial attacks, either relapses or fresh infections; even in the South the morbidity fell from between 35 and 80 per cent. to 18 per cent. (*Bulletin Pasteur*, 1906).

(2) *Mechanical protection* against mosquitoes has been continued and extended by the railway administrations; on the Adriatic system, of 10,000 persons so protected at malarious stations, 11·41 per cent. suffered from fever; this is but little more than the percentage of fever cases (10·39) occurring among 26,568 persons employed in non-malarious, or only slightly malarious stations, where no protection is afforded (or required); the result is therefore very favourable.

Celli considers that there is no longer any need to dwell on the value of this method of prophylaxis; it is thoroughly established. It is now applied in the rice fields of Lombardy, wirework sleeping places for the "pruners of rice" being provided in the summer. In Corsica and in Sardinia, where are some of the most feverish districts of the whole kingdom, a combination of mechanical *plus* quinine prophylaxis is said to have given in some places perfect results. On the east coast of Corsica the morbidity fell from 50 per cent. of the inhabitants to 11·5 per cent. (in 1905), the cases being mostly relapses (Laveran).

Some important generalisations are contained in the last Reports of the Italian Society for the study of malaria (1906).

(1) Spontaneous disappearance of paludism: this has taken place in the Agro Sarnese, one of the most fertile valleys in Southern Italy (in which lies Pompeii); here malaria is now only found in the commune of Sarno, and in two restricted zones. The improvement in the drainage has, however, been very rudimentary; the marshes are still there and with them *Anopheles maculipennis* and *bifurcatus*. There has been a great development of irrigation, with extension of the artichoke culture, and of rice fields after the Chinese fashion, by which the rice is transplanted, not sown (this is said to be the only example in Europe). The existence of *anophelism* without paludism has not yet been explained. (2) Improvement in drainage should first be undertaken in a malarious locality; then improvement in agricultural methods, *i.e.*, regular and careful cultivation; then should follow the new anti-paludic measures. (3) Economic result: in Sardinia the expenditure of 3,500 *lire* in quinine has resulted in a saving of more than 10,000 *lire* value in day's work; of course, no account is taken of any *future* good resulting from this diminution of fever, it merely refers to the net economic result of one year's operations.

It is impossible to study the accounts of the measures taken in various parts of Italy to exterminate, or at any rate alleviate, the effects of this scourge of malaria, without admiring the energy and determination with which the problem has been attacked, and rejoicing in the magnificent success that has in so many instances resulted therefrom. It may well be asked, What have we to show in comparison? in India? in West Africa? Are our resources less than those of Italy? or our knowledge of what ought to be done? or our energy in applying the knowledge we possess?

Tuberculosis.—The Royal Commission, of which the late Sir Michael Foster was chairman, have recently issued a second interim

report (January, 1907). In their former report of 1904 they had shown that cattle fed on, or inoculated with, human tubercle bacilli from various sources, had become infected with tuberculosis; the disease set up in the animal by human, was compared with that set up by bovine, tuberculosis, and found to be identical. In the present report are related the results of experiments with the bacilli of bovine tuberculosis, which have been introduced into other animals by feeding, and by injection, both subcutaneous and intravenous, and in some instances intramammary. The animals experimented on have been calves, monkeys (rhesus, baboons and lemurs), and anthropoid apes (chimpanzees), also pigs and other animals. The effects have differed in degrees of severity, but progressive generalised tuberculosis was produced in each group of experiments (except in rats). The Commissioners summarise the results of their experiments thus:—"The bacillus of bovine tuberculosis is not so constituted as to act on bovine tissues only, for it can give rise to tuberculosis in many animals other than bovine; it is not even so constituted as to act on bovine tissues with a special energy, for it can give rise to tuberculosis in some other animals as readily as, or even more readily than, in bovine animals themselves. We call it the bacillus of bovine tuberculosis merely because we find it most frequently in the bovine body, it being the cause of bovine tuberculosis. The fact that the bacillus of bovine tuberculosis can readily, by feeding as well as by subcutaneous injection, give rise to generalised tuberculosis in the anthropoid apes—so nearly related to man—and, indeed, seems, so far as our few experiments go, to produce this result more readily than in the bovine body itself, has an importance so obvious that it need not be dwelt on." It can hardly be doubted that, if experiments could be made upon man, the results would be same; numerous instances of unintentional inoculation have been recorded in recent years, as amongst veterinary surgeons by Nocard.

The Commissioners have also experimented with the bacilli of human tuberculosis. They find two principal groups of viruses of human origin. The viruses of group 1, tested on calves, monkeys, and many other animals, were found to give results identical with those obtained from bovine bacilli: "We have failed to discover any essential differences between the one and the other; both are equally virulent, that is, equally able to set up tuberculosis in bovine and other animals." The viruses of group 2 were found to be much less pathogenic to bovines and other animals than those of group 1; generalised tuberculosis was not produced in most cases (except in

guinea-pigs, monkeys and the chimpanzee), but a limited retrogressive condition. A third group of viruses of human origin showed intermediate characters, the significance of which will be considered in a future report.

The Commissioners conclude by stating distinctly that "in a certain number of cases the tuberculosis occurring in the human subject, especially in children, is the direct result of the introduction into the human body of the bacillus of bovine tuberculosis; and there can also be no doubt that in the majority at least of these cases the bacillus is introduced through cows' milk. . . . Our results clearly point to the necessity of measures more stringent than those at present enforced being taken to prevent the sale or consumption of such milk."

Effects of Hunger and Fatigue on Bacterial Invasion of the Organism.—By preparing sections through the intestinal coats of newly-born rabbits Ficker[1] has shown that certain bacteria penetrate the walls and make their way into the blood and organs, this occurring especially in the upper part of the small intestine; in guinea-pigs this penetration appears to take place less freely.

Ficker submitted various animals to complete starvation, and after varying intervals fed them on the easily recognisable red bacillus of Kiel; the animals were then killed and cultures made from the blood and organs. In adult rabbits so treated after a fast of six or seven days, the bacteria were found disseminated through the blood and in the organs; this occurred also, but only in 35 per cent. of the cases, in rabbits fed on bacteria, but not starved. He then found that in rabbits, after a fast of some days, the normal bacteria of the intestine could be discovered in the blood and organs; in dogs this was found to occur after twelve or thirteen days' abstinence.

Subsequently Ficker studied the effects of fatigue in dogs, who were submitted to work in an electric mill; work of from one to three hours did not suffice, but after six hours it was found that *B. coli* had passed into the kidneys, liver and mesenteric glands, and after a longer time *proteus* was found in the organs and in the blood as well. With starvation and fatigue combined the red bacillus of Kiel passed through in three hours.

These researches throw light on the pathology of fatigue fever; and on fatigue as a factor in causation of infection, especially in

[1] *Archiv. f. Hygiene*, liv. and lvii.

conjunction with want of nourishment, also on the cases of poisoning following on ingestion of the flesh of over-driven animals.

Infectious Disease and School Closure.[1]—The Local Government Board issued a Memorandum in 1904 in regard to the closing of schools for infectious disease, in which it was pointed out that whether an outbreak might be best combated by closing the school, or by excluding the children from infectious households, depended upon: (1) the completeness and promptness of the information received as to occurrence of cases; and (2) the opportunities for intercourse between children elsewhere than at school. If the cases are few and their origin known, and known promptly, probably the exclusion of children from infected households will suffice, but not otherwise. As to opportunities of intercourse between children in sparsely populated districts, where children rarely meet except at school, closure may effectually check spread of disease; it is less likely to be successful in a town or populous place.

The practice as regards school closure in the London County Council area has recently been considerably modified, chiefly through the measles enquiry at Woolwich, and bacteriological laboratory experience in regard to diphtheria. As to scarlet fever, Dr. Kerr believes that "the infectiousness of such cases before the child vomits or the rash appears is probably considerably overrated. A child without other symptoms, but with the rash just appearing, is possibly not very infectious; where, however, there is any suspicion of scarlet fever, any child who vomits at school should be sent home at once, the room should be cleared of children for the day, the ejected matter promptly removed, and strong disinfectants used, as it is unsafe to regard this material as other than a source of contagion." "Peeling" is not looked on as particularly dangerous; the really dangerous "carrier" cases are convalescents with suppuration or catarrh of the ear or nose; some suppurating patch about the nasal sinuses or turbinated bones may keep up infectiousness for months. Such diffusion as occurs through school attendance is probably chiefly due to convalescents. In the case of *diphtheria* there is the same danger of convalescent "carriers"; the London school experience is "that for practical purposes the detection of the Klebs-Loeffler bacillus in the throat, nose, or ear of any school child, however well the child itself may appear, requires the exclusion of the child till it is free from the organism. . . .

[1] See *Army Medical Regulations*, 1906, para. 147.

To other organisms than the Klebs-Loeffler bacillus we do not attach importance" (*Report* for 1906). After consultation with the Medical Officers of Health Society the London County Council resolved "to refuse, during the presence of diphtheria in any district, re-admission to school of children excluded on account of diphtheria or sore throat, until such children shall have obtained a medical certificate of freedom from infection based on a bacteriological examination." The Council have also instructed teachers that no child who has been in an infectious diseases hospital should return to school for at least a fortnight after discharge. The Metropolitan Asylums' Board recommend that this period should be three weeks.

In regard to the non-notifiable infectious diseases, there has been a modification in procedure in London and elsewhere. Measles is the most important of these complaints. It does not seem to spread unless between 30 and 40 per cent. of the children have not previously suffered; and it ceases to spread when only 15 to 20 per cent. remain unaffected. Under the conditions that obtain in London at present, it follows that this disease may be neglected in schools above the infant department.

The following are the present rules in force by the London County Council:—Children suffering from measles must be excluded from school for at least one month; from mumps, for one month; from chickenpox, for at least two weeks, or until every scab has fallen off the scalp or the body; from whooping-cough, as long as the cough continues, and not less than five weeks from the commencement of the whooping. Children coming from houses where these diseases exist must be excluded, if in infants' schools; in other schools only those who have not had the disease need be excluded. The period of this exclusion will be, in measles (1) for infants' schools, until the Monday following the expiration of fourteen days from occurrence of *last* case; (2) for other schools, until the Monday following the expiration of fourteen days from occurrence of *first* case; in mumps, for three weeks, or such time as medical attendant requires; in chickenpox and in whooping-cough, for two weeks.

If this exclusion could be carried out effectively, there would probably be little need for the extreme step of closing schools. One of the most important points of all is the *early recognition* of infectious cases; the school teachers have unequalled opportunities for observation of the children under their care, and it is necessary that they should be acquainted with the early signs and symptoms of these diseases, so that they may take immediate steps, referring, of course, to the medical officer in every case im-

mediately. (See "Manual of Hygiene for Teachers in Army Schools.") A regular inspection of schools by a medical officer in order to pick out the earliest cases of infection would be the best plan, better than closing schools after the attendance has fallen 30 or 40 per cent.; but this is not universally practicable, whereas it is practicable for teachers to be of the greatest service by taking the preliminary step of looking for and recognising early cases.

VI.—Legislation.

There is no sanitary legislation of great importance to be recorded during the past year. The Workmen's Compensation Act, 1906, makes provision for compensation for industrial diseases; those at present named are anthrax, ankylostomiasis, and poisoning by lead, mercury, phosphorus and arsenic. A Departmental Committee has been appointed to consider what diseases should be added to this schedule, and it may be expected that there will eventually result improvement in the health of the artisan population affected.

Clinical and other Notes.

NOTES ON A CASE OF LIVER ABSCESS TREATED BY "VACCINATION."

By Captain D. HARVEY.
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Gunner B., 75th Battery, R.G.A., was admitted to the Station Hospital, Calcutta, on October 15, 1906, with fever and diarrhœa; at the time of admission there was neither blood nor mucus in the stools and the patient gave no history of rigors or of excessive sweating. The fever for the first week was continuous, but never rose above 101° F., and was usually a degree or so lower in the morning; the temperature was normal on the eighth day after admission. He then had intermittent fever for three or four days, his temperature reaching 100° or 101° F. at night and falling to normal in the morning.

About this time some blood and mucus were noticed in the motions, but the stools were not typically dysenteric; indeed, at times a typical "pea-soup" stool was passed, also "bilious" ones. The fever again became continuous and remained up for a few days, falling to normal about the twentieth day of his illness.

At this stage the case came under my charge as one of "simple continued fever." I carefully examined films of his blood taken at different times, but failed to find any malarial parasites, and a differential count of the white cells pointed rather to inflammatory trouble than to typhoid or malaria. On examination of the chest, an area which was dull to percussion was discovered at the base of the right lung, with absence of breath sounds and loss of vocal resonance. This area was not appreciably altered in extent by movement. The area of liver dulness was normal in breadth in front and the spleen was slightly enlarged. The abdomen was not distended but was tender to pressure; this tenderness was present in, but not confined to, the right iliac fossa; in this situation gurgling was elicited on deep pressure. A Widal test was made and an undoubted positive reaction obtained in a total dilution of 1 in 40, both under the microscope and in the sedimentation tube. The clumping was very rapid and was complete in ten minutes. A control done with another patient's serum, not typhoid, was negative, at the same time and in the same dilution.

This seemed to clear up the diagnosis, but not altogether, as the patient still had intermittent fever and his appearance was not typical of typhoid.

He now became rapidly worse, lost flesh and sweated; he complained of no pain over the liver, either at this time or previously. I accordingly made a second Widal test two days later, putting dilutions up to 1 in

1,000; only the 1 in 20 gave a positive reaction and that even was not complete. A blood count made at this period showed that the red cells were reduced to about half the normal number; there was a marked polynuclear leucocytosis, over 90 per cent. of the leucocytes being polynuclear cells; there was also an absolute leucocytosis, about 11,000 white cells to the cubic millimetre. It appeared from this that, if the case was one of typhoid, it was not uncomplicated, and, in view of the result of the second agglutination test, there was a doubt as to its being a case of typhoid at all. The area of dulness behind on the right side had extended upwards, and also there was an increase upwards of the liver dulness in the mid-axillary line, or, rather, there was an area of dulness in the mid-axillary line continuous with the liver dulness and with the dull area at the base of the right lung. The question was, then, was this an encysted collection of pus in the right pleural cavity, or was it a liver abscess? The latter supposition was certainly much the more probable.

A needle was introduced in the mid-axillary line in the eighth interspace and a quantity of greenish pus drawn off: while *in situ* the needle moved with respiration, showing that the abscess was below the diaphragm.

The following day the patient was prepared for operation, and I resected a portion of the eighth rib and opened at once into a large abscess cavity; large quantities of "liver" pus flowed away. A drainage tube was placed in the opening. On examination, the pus was found to contain large numbers of the *Amœba histolytica*, but no cocci or bacilli were seen, and the pus proved to be sterile on culture in broth and on agar.

For a week after the operation the patient did excellently, his temperature remained normal, he felt well in himself, and the diarrhœa disappeared, showing that the liver was resuming its functions. The discharge at first was very profuse but "sweet," and contained enormous numbers of amœbæ, but now, *i.e.*, a week after the operation, some cocci in groups were seen.

From this time onwards the case did not progress satisfactorily; he again got fever at night and the temperature was higher than before the operation. The discharge became more profuse and was foul and altered in appearance. The patient went down hill rapidly, he became extremely emaciated, and his pulse at night was wretched. Major L. Way, R.A.M.C., kindly examined the case with me, and we decided that there were no indications of a second abscess, unless possibly it might be deep in the liver tissue, although it was difficult to understand why a second abscess should give rise to much more serious symptoms than the original one had. He now had on attack of diarrhœa with blood and mucus in the stools, and the prognosis was a very bad one indeed.

I then decided to try him with a vaccine made from the coccus in the pus. I isolated *Staphylococcus aureus* in pure culture and made a

vaccine containing about 80,000,000 cocci per cubic centimetre; this was killed by heating to 60° C. for forty-five minutes. One cubic centimetre of this vaccine was injected subcutaneously into the pectoral region; no local effects were complained of.

Previous to this first injection his opsonic index for this coccus was below normal—·8. After the first dose of vaccine his temperature fell to normal and has remained so ever since. The external wound, which had become very much inflamed, began to show signs of healing, and healthy granulations appeared. The drainage tube, which had required to be lengthened, on account of breaking down of the wall of the cavity, was now pushed out, and three-quarters of an inch were cut off it. A second dose of vaccine was given eight days after the first, and the patient continued to improve. His opsonic index for the coccus, taken four days after the administration of the second dose of vaccine, was 1·4, having been almost doubled in ten days' time.

The patient is now convalescent and the tube has been removed, a gauze drain being put in its place. I admit that the sudden and marked improvement in the man's condition after the first dose of vaccine may only have been a coincidence, but certainly it was not coincidence that raised his opsonic index from ·8 to 1·4 after two doses of vaccine.

This type of case I believe to be fairly common; a large single amœbic abscess is opened, for a few days the patient does very well, then the cavity becomes septic, the patient gets fever, higher and more severe than before the operation, he goes rapidly down hill, and either dies with toxic symptoms, or recovers after a long and tremendous struggle against the invading organism. Cases like the above may be due to the presence of a second abscess, but are more often simply due to a septic infection of the large cavity in the liver.

Treatment of chronic, or acute, suppurative processes by means of vaccine is, of course, not new, but I believe it has not so far been tried in cases of liver abscess; I therefore bring it to notice, as I believe that in this instance it saved the life of the patient.

One point of interest in the case was the positive Widal reaction obtained in the third week of the illness. At first I was inclined to think that this was a fallacy due to using distilled water as a diluent for the serum, but the control serum with the same diluent and the same broth culture gave a negative result. Recently, a Russian observer has pointed out that, in cases of jaundice, catarrhal, and due to other causes, a positive Widal reaction is sometimes obtained. At the time of making the test the patient was not jaundiced, but his liver was disorganised, and it is possible that the presence in the serum of some abnormal secretion, or the absence of one normally present, may have given rise to the phenomenon. If this was so, then other cases of liver abscess should at times give a positive reaction. That it was not constant in this case was shown by the fact that a few days later only a modified result was

obtained in a low dilution, altogether different from the rapid and complete result obtained on the previous occasion.

Another point of interest is in connection with the count of the white cells of the blood; there was a marked relative leucocytosis, but apparently only a slight absolute leucocytosis. But it must be noted that, at the time when this count was made, the red blood cells were only half the normal number; if, then, the white cells had been present in normal ratio there would only have been 4,000 in the cubic millimetre, whereas there were 11,000, or nearly three times the normal. The normal ratio of white to red is about 1 in 700; in this case it was 1 in 300 or thereabouts.

Major Rogers, I.M.S., has pointed this out and recommends that a count of the red cells should be made in all cases of suspected liver abscess, otherwise a true absolute leucocytosis may be missed. Thus, if a case showed 10,000 white cells to the cubic millimetre, and no count of the red cells was made, it might be said that the white cells were only slightly over normal, whereas, if a red cell count was made and it was found that the red cells were only 2,500,000 per cubic millimetre, then there are really more than twice the proper number of white cells present.

In conclusion, I beg to express my indebtedness to Lieutenant-Colonel Franklin, R.A.M.C., for his kindness in allowing me to publish these notes; to Major L. Way, R.A.M.C., for assistance throughout the course of the case; to Major McDermott, R.A.M.C., for assistance at the operation, and to Assistant Surgeon Kidby for the able manner in which he has looked after the case throughout.

NOTES OF CASES OF MEDITERRANEAN FEVER OCCURRING IN GIBRALTAR DURING 1906.

By Major W. H. HORROCKS.
Royal Army Medical Corps.

During the year 1906, three cases of Mediterranean fever were reported amongst the civil population. The first case was notified on May 19th, the second on November 27th, and the third on December 17th. There were no cases amongst the troops. The particulars of the civil cases are as follows:—

Case 1.—J. A. T., aged 30, a native of Gibraltar, employed as a shop assistant, was in good health until May 7th, when he began to suffer from continued fever. His blood was examined, and the serum, diluted 1 in 160, caused complete agglutination of the *Micrococcus melitensis* in half an hour. The man stated that, being somewhat debilitated, he had been in the habit of drinking daily a glass of goat's milk, which was boiled by his wife. The other members of his family used condensed milk. At the time when the fever developed there were

no mosquitoes or biting flies to be found, and the sanitary condition of the house was above suspicion. Also, no cases of Mediterranean fever had been reported since November 5th, 1905. The goat's milk consumed by the patient was brought from Spain, several gallons being consigned to a contractor, who again retailed it. The goats supplying the milk could not be examined, so a sample was taken from the next consignment received after the notification of the case, and tested for agglutination. The deposit from 50 cc. after centrifugalisation was also plated on nutrose agar. The milk gave no reaction, and the *M. melitensis* could not be recovered. The man attributed his illness to the consumption of fresh cheese made from goats' milk. On April 23rd he visited the neighbouring Spanish town of Linea and ate heartily of this particular variety of cheese; a few hours later he felt ill, but speedily recovered and was in his usual state of health until April 7th, when fever set in. Fresh cheese is made by coagulating goats' milk with rennet; the curd is then placed in a mould to drain, and may be eaten eight hours later, but usually twenty-four to forty-eight hours elapse before it is consumed. Knowing from previous examinations that some o the goats in Linea are infected, it appeared possible that the *M. melitensis* might have been retained in the curd and caused the infection. Unfortunately, fresh cheese could not be obtained in May, as the dairymen stated that it was only made in the months of February, March and April, when milk was so plentiful that all of it could not be sold for drinking purposes. The cheese received had been made three weeks, and though dilute emulsions were made and plated on nutrose-agar, the *M. melitensis* could not be recovered.

CASE 2.—F. A., aged 22, a native of Gibraltar, having been in delicate health for some time, went to reside on a farm close to the Spanish town of San Roque, during the months of July, August and September. While at the farm he drank milk supplied by a small herd of goats. On October 8th he returned to Gibraltar, apparently in good health, but twelve days later developed continued fever, and on November 26th his blood serum, diluted 1 in 160, completely agglutinated a recent culture of the *M. melitensis*. The farm was then visited, and the herd found to consist of twenty-eight goats, one being of pure Maltese descent. A sample of blood was taken from each of the goats, and the serum tested in the usual manner. The sera obtained from four of the goats caused agglutination of the *M. melitensis*; one, a spanish goat ("Harropa"), reacted in a dilution of 1 in 40, and the remaining three, two Spanish and one Maltese, reacted in a dilution of 1 in 10. Unfortunately, all the goats were found to be pregnant, and milk could only be obtained from the Spanish goat "Harropa" and from the Maltese goat "Paloma." The milks were diluted 1 in 5, and tested with *M. melitensis* for an agglutination reaction. The milk of "Harropa" caused instantaneous clumping, but that of "Paloma" gave no reaction. Ten centimetres of the

milk from "Harropa" were then centrifugalised, and the deposit plated on litmus-nutrose agar; the *M. melitensis* was readily isolated from the plates. The chain of evidence in this case appears complete; there can be little doubt that the man acquired Mediterranean fever by drinking infected goats' milk.

CASE 3.—J. A., the captain of a British sailing ship, arrived in Gibraltar on December 7, 1906, and was seized with fever the same day. He stated that he had recently discharged a cargo of timber in Malta, and remained there thirteen days. He slept on board his ship, but frequented *cafés*, where he used to drink two or three glasses of goats' milk daily. He had visited Malta on four previous occasions, but always drank whiskey or beer in the *cafés;* this year, being an abstainer, he only drank milk. Seventeen days after leaving Malta, while at Marseilles, he suffered from fever, which subsided after about a fortnight; he then sailed for Gibraltar and had a relapse immediately on his arrival. He was admitted into the Colonial Hospital, and a specimen of his blood being obtained, the serum, diluted 1 in 40, was found to completely agglutinate the *M. melitensis*, the clumps being visible with the naked eye.

In Gibraltar the supply of goats' milk is most plentiful during the months of February, March, April, May and June. It begins to rapidly decrease in July, and is comparatively scarce and much dearer during the winter months. Owing to the favourable temperature and rich pasturage in the spring, the goat-herds arrange that the female country goats shall be impregnated, so as to be in milk at this time of the year. In order to obtain the winter supply of milk, stall-fed goats of better breed coming from Malaga are covered, so as to give milk from September to December, but the quantity available is comparatively small. The increased supply of milk during the early summer months may help to explain the rise in the Mediterannean fever wave, which used to occur during March, April, May, June and July.

INCONTINENCE OF URINE IN THE SOLDIER.

By Major P. G. IEVERS.
Royal Army Medical Corps (R.).

HAVING had a few outbursts of this malady to deal with from time to time, I should like to give my experiences, and, in the first place, I have noticed that previous writers on the subject in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, when going into the etiology of this affection, do not appear to have been struck by the important part played by the season of the year. In this connection I have invariably found that, when the occurrence prevailed almost in epidemic form, the nights were long and the weather very cold. But coming to the investigation of the individual case, the latter can, as a rule, be divided into three classes :—

(1) In the first no doubt we do come across a few—very few—instances of genuine atony of the bladder, in my opinion the result of defective early training in control of the bladder, and the habit becoming confirmed is sometimes carried on into manhood. I should like to try the effect of circumcision on all such cases in childhood, as I have no doubt it would prove beneficial in this as in other ways. I have found treatment of little avail in such cases, still less punishment or even pecuniary loss, and for this class invaliding seems to be the remedy.

(2) In this category I include all cases suffering from irritability of the bladder, whether the cause be stricture, neglected gonorrhœa, or a condition of hyperacidity of the urine from whatever cause; bowel trouble, too, such as colitis, often occasions excessive irritability of this organ. In all cases of this kind the cause must be carefully ascertained and removed, when, of course, the incontinence, which was merely a symptom, at once disappears.

(3) In this, the third class, which is by far the most numerous, I think it will generally be found that there is a good deal of heavy drinking going on, and the culprits, having to choose between getting up and relieving their bladders in the ordinary way (being naturally of irregular habits and regardless of decency), commit themselves at the expense of their beds and bedding. A simple but very effective procedure in dealing with such gentry is to have a parade at uncertain times of all bedding, the latter to be ranged up in a conspicuous place in barracks. The lazy ones can then no longer hide their shame, besides which, a man of this sort would think twice before committing himself, when he finds that he has to face the quartermaster's bill on the one hand and the wholesome chaff of his comrades on the other, the moral effect of which latter is most salutary. A few such parades, carried out systematically, have a wonderful effect in checking epidemics of this nuisance, and I desire to commend a trial to such of my brother officers who may find themselves called upon to deal with an outbreak under similar circumstances.

MOSETIG-MOORHOF'S METHOD OF TREATING BONE CAVITIES.

By Major ROBERT J. BLACKHAM.
Royal Army Medical Corps.

With reference to Captain F. F. Carroll's paper on Professor Mosetig-Moorhof's method of filling bone cavities with iodoform wax in the September issue of this Journal ("Some Notes on Continental Surgical Procedure," vol. vii., p. 255), the following account of a case in which this new treatment was put into practical application may be of general interest.

E. R., aged 6, the daughter of a sergeant in the Royal Marine Light

Infantry, was admitted into the Military Families' Hospital of Devonport on April 23rd, 1906, suffering from advanced tubercular disease of the knee-joint. After consultation, it was decided to excise the joint, adopting the procedure of Professor Mosetig-Moorhof. The operation was undertaken on April 30th, 1906, with the able assistance of Captain F. F. Carroll, R.A.M.C.

On opening the capsular ligament the joint cavity was found full of tubercular granulation tissue which was almost black in colour. The patella had been invaded by the disease and was removed early in the operation. The tubercular tissue was carefully scraped away, but in the process of clearing out the joint it was found that the head of the tibia was occupied by a large abscess cavity which was discharging, through an opening in the bone, behind and below the joint. The pus, from its point of exit, had tracked its way down the calf and occupied the plane between the gastrocnemius and soleus muscles. The condition of the limb appeared almost hopeless, as if a slice of bone had been removed from the head of the tibia it would have opened up the abscess cavity, while the collection of pus behind the joint was flowing freely into it and bathing the whole of the tissues in tubercular matter. At this stage it was regretted that permission to amputate had not been obtained. We decided, however, to give the limb a chance, and having made a counter-opening through skin and muscular tissue in the calf, we washed out the joint and abscess cavities in the bone and muscle with weak lysol solution. The joint was then irrigated with a 1 per cent. solution of formalin, and an attempt made to dry the walls of the cavity with the contrivance which Captain Carroll refers to in his interesting paper.

Unfortunately, although the arrangement of two bottles and a double rubber bag sounds "very simple" on paper, it is not so easily managed in practice. I had an apparatus made by a local chemist, but it would not work at the crucial moment, and we were obliged to imitate Dr. Silbermark's electric heater, with an ordinary Pacquelin's cautery. The *iodoform-knockenplombe*, which had been liquefied by heat, was then slowly poured into the joint. It set in a few minutes and the superficial soft parts were then united.

The incision wound healed up rapidly, leaving a small sinus which discharged serum mixed with iodoform for about two weeks and then closed up. The child rapidly improved in health and put on weight. The limb, however, was useless, as there was only a limited amount of fibrous union between the articular surfaces.

I therefore reopened the joint on August 28 and found that the abscess cavity in the tibia had completely filled up with new bone, that there was no granulation tissue in the joint, and that the ends of the bone were quite healthy. I performed an excision in the ordinary way, and as an additional precaution pegged the ends of the femur and tibia together with ivory pegs.

The operation wound healed by first intention and I removed the pegs in six weeks. The bones united in the most firm and satisfactory way, and the child went out of hospital on November 17th with a perfectly useful limb.

As this appears to have been the first occasion on which Mosetig-Moorhof's method has been used in a military hospital in England the case appears worthy of record. I am of opinion that no other method of treatment would have saved the limb in the condition in which it was found last April.

I am much indebted to Captain Carroll for explaining the technique of the method and assisting in the first operation.

A CASE OF ENTERIC FEVER COMPLICATED WITH AN EMPYEMA, THE EXCITING ORGANISM BEING ONE OF THE *BACILLUS COLI*, OR TYPHOID INTERMEDIATE GROUP.

By Captain E. C. HAYES.
Royal Army Medical Corps.

Private T. was admitted into hospital on December 17th, 1905, suffering from a continued pyrexia, malaise, furred tongue, &c. There was also some diarrhœa—about four stools *per diem.* No enlargement of the spleen could then be detected, nor was there any crop of rose spots. At first Widal's reaction was negative, but about the tenth day a very definite reaction took place, and he was accordingly diagnosed enteric fever. Preventive measures of disinfection were taken both in hospital and barracks. The origin of the disease is most obscure.

It is many months since a case occurred amongst the troops in Colombo, and this man has not been at any other station for the past twelve months. He is a teetotaller, and has been known to have recently visited an hotel at Borella, which is now "out of bounds." Many cases have been reported amongst the civil population in this suburb of Colombo, and it is probable that infection was here contracted. The case has been of a severe type as regards pyrexia, but the clinical symptoms were not very characteristic. Subsequently his spleen became enlarged to a medium extent. There occurred towards the end of the first fortnight definite signs of congestion of the bases of both lungs, and the fever, which seemed about to drop by lysis towards the normal, assumed a higher type. It became much more remittent within a few days, when patches of broncho-pneumonia were detected on percussion and ascultation. His general condition became very low and of an asthenic type. Free expectoration was produced on the administration of stimulating expectorants, alcohol, and local fomentations. The expectoration was of a highly offensive nature, suggesting abscess of the lung. No elastic tissue was identified under the microscope. Remittent fever, high at

night, 103° F., with morning remission to 99° F., continued to run a chronic course. Examination of the chest revealed transient patches of dulness, and deficiency of tactile vocal fremitus was found on both sides. Empyema was suspected and the left pleura explored with a needle on January 28th, but with negative results. Marked symptoms of collapse occurred, but hypodermics of liq. strych. and brandy brought him round. Four days later, the dulness being more marked on the right side and the patient's condition somewhat improved, the right pleura was aspirated and 4 ounces of a thin pus was removed; but symptoms of collapse again occurred, and the evacuation had to be abandoned. Liq. strych., brandy and ether were again exhibited hypodermically, but the patient's condition of shock rapidly deepened after a transient improvement, and he died three and a half hours later.

Post-mortem Examination.—A partial *post mortem* was made the same afternoon, the abdomen and thorax being opened. The small intestines were thinned and in a papyraceous condition in many places, and revealed old cicatrised Peyer's patches, as well as large areas recently inflamed, red and injected vessels being present. There were no lesions in the large intestines. His spleen was enlarged and soft, and weighed 14 ounces. His liver was slightly enlarged, and the intra-connective tissue showed signs of cirrhotic change. The kidneys were in a like condition. In the thorax marked changes were discovered; the entire right lung was small and contracted, patches of absolute solidification in large areas, involving practically the whole lung, being present; a small abscess cavity about the size of a hazel nut opened by two fistulæ into the pleural cavity. The latter contained 16 ounces of a thin pus; its walls were thickened and the parietal layer adherent all round. It was covered by a thick coating (pyogenic membrane). The right lung was the seat of a muco-purulent bronchitis in its upper lobe; the lower was absolutely solid and of a liver-like appearance on section.

The pus in the pleural cavity on microscopical examination was seen to be teeming with a small motile bacillus. For the purpose of ascertaining its identity, various cultural reactions and inoculations were undertaken. The culture was, in the first place, found to contain two organisms, *i.e.*, the small motile bacillus referred to, and also a large coccus, either the *Staphylococcus pyogenes aureus* or *Sarcina lutea.* At any rate it was Gram-staining, and on agar rapidly grew at 37° C., producing well-marked colonies of a chrome yellow. The grouping of the cocci were more suggestive of the Sarcinæ than the Staphylococci. With regard to the bacillus, it grew freely at 37° C. on agar in a fine white manner. It produced acid and gas in McConkey and Hill's medium, and this points to its being an organism of abdominal type, probably the *Bacillus coli.* This fact is interesting as regards the relation of this bacillus to the *Bacillus typhosus*, and the change from one to the other.

A CASE OF ULCER OF THE DUODENUM WITH PERFORATION.

By Lieutenant-Colonel F. J. GREIG.
Royal Army Medical Corps (R.P.).

E. C., a miner, aged 20, was admitted to my ward in the Stirling Royal Infirmary on September 8th, 1906, in the evening. The patient gave a history of a sudden acute attack of abdominal pain which seized him at 2 p.m. the same day as he was walking home. The pain was so severe as to cause him to lie down on the side of the road, was continuous, and quite prostrated him. There was no history of sickness or vomiting, and the bowels, which usually acted regularly, were, he stated, freely moved the previous day after four days' constipation. There was little previous history of any definite illness, except some malaise and occasional nausea.

Condition on Admission.—Temperature 99·2° F.; pulse 120. Had an anxious, drawn expression; lips dry and harsh; tongue coated with a yellowish fur. Abdomen, on visual examination, was a little distended. Palpation impossible owing to extreme rigidity of the abdominal wall, but there was great tenderness over the whole of the abdomen, especially, it was thought, in the right iliac region, about the situation of the appendix. Abdomen was resonant all over. Rectal examination revealed nothing abnormal. Hot fomentations and 3 grains of calomel were ordered, and a simple enema brought away two or three hard fæcal masses of small size. An olive oil enema was given with no result, and one of turpentine removed two or three small scybalæ.

September 9th.—Abdomen markedly distended, tenderness not so extreme. Great irritability of the bladder—about one ounce of urine passed at each act of micturition. No albumen in the urine. Pulse weaker, 138. Temperature 98·4° F. A loud friction was heard, concomitant with breath sounds, over the liver in front, and at the base of the right lung behind, while there was great pain in the right shoulder. The patient was very thirsty. No jaundice. On consultation, an operation was decided on that evening, and, assisted by my colleague, Dr. W. Eggeling, I opened the abdomen over the appendix. A large quantity of pus was evacuated. The appendix was much congested but otherwise healthy. Bowel much congested and covered with flakes of lymph. As the patient was pulseless, although strychnine was administered hypodermically half an hour before the operation, again during the operation, and he was transfused with saline solution while on the table, it was impossible to do more than insert two large-sized drainage tubes well down into the peritoneal cavity, and close the wound between the tubes. The patient was taken back to bed, was given brandy enemata every hour, and saline solution was injected under the subcutaneous tissue of the breast. He failed to rally, and died at 6 a.m. the next morning.

Autopsy.—On opening the abdomen pus was found diffused all over

the peritoneal cavity. Fibrinous exudation most marked over the peritoneum covering the liver. On handling the stomach the gastric contents gushed through a duodenal perforation situated just outside the pyloric orifice. The stomach and duodenum were ligatured and removed, and, on opening these, a terraced ulcer was found in the first part of the duodenum, with an oval perforation measuring almost a quarter of an inch in its longest diameter.

Remarks.—This case is interesting as showing the difficulty of diagnosis. The patient had practically no symptoms until the perforation occurred, although this is not uncommon in cases of ulcer of the stomach or duodenum. This was probably due to the fact that the ulcer was protected by a fold of mucous membrane. The symptoms on admission suggested fulminant appendicitis, though the probability of a perforation of the stomach or bowel was discussed. Irritability of the bladder is often noticed as a symptom of appendicitis. The autopsy revealed no pleurisy. The loud friction sound was entirely due to peritoneum, roughened by lymph, over the liver and the under surface of the diaphragm.

I am indebted to Dr. G. S. Banks, House Surgeon, for taking the notes of the case for me.

A CASE OF TRANSPOSITION OF THE HEART.

By Lieutenant R. G. H. TATE.
Royal Army Medical Corps.

The patient, a private of the 3rd Dragoon Guards, was admitted to hospital on May 12th, 1906, suffering from tubercle of the lungs. The features of the case to be described are of interest on account of their rarity, rather than their general medical importance.

The pulmonary mischief from which the patient was suffering on admission to hospital would appear to have originated in a severe chill, followed by catarrhal symptoms, caught during March, 1906, whilst in a camp of musketry in Tipperary. From that time until the date of his entry into the Royal Infirmary, Dublin, he had a severe cough, with expectoration, and lost weight rapidly, but never felt ill enough to report sick. All the man's family were healthy, and he himself had been of robust physique as long as he could remember. The ultimate cause of his being sent to hospital was, that whilst playing in the band, he was noticed to become suddenly ill, and, on his fainting, he was taken to the Royal Infirmary for treatment.

On his arrival both lungs were found to be in a serious condition: dulness on percussion and crepitation on auscultation were found over the apices, and loud râles and rhonchi were heard over both sides of the chest, both back and front. Large quantities of tubercle bacilli were found in the sputum. The heart was found to be out of its normal position, and the areas of both deep and superficial cardiac dulness were

with difficulty traced out. On the left of the sternum no dulness was found on percussion, but on the right side a large dull patch was discovered. The limits of this area were defined, but its presence was not looked on as indicating any condition for whose existence full reason could not be found. At the site of the normal apex-beat the heart sounds were faintly heard, whilst over the second intercostal spaces the stethoscope showed little amiss, the only abnormality being a weakening of the sounds, which could have been accounted for by the debilitated state of the patient. The presumption from these signs was that the heart had been displaced by some such causes as fluid, which had been formed at some earlier date and absorbed, or by retraction of diseased lung tissue.

One day, whilst an examination of the chest for the purpose of determining the progress of the disease was being made, it was noticed that pulsation in the epigastrium was well marked, and also that it was more noticeable on the right than on the left side. Again, it was found that the dulness on the right side came right down to the costal arch and, so to speak, ran into the pulsating area. The next steps taken were to accurately map out the upper border of the liver by percussion, and also to find the exact limits of the dull area mentioned above. The result was that an area was mapped out, the upper border of which was a curved line, with its convexity upwards, stretching from the lower border of the third right costal cartilage to a point 3½ inches from the mid-sternal line, in the fifth right intercostal space, and separated from the liver dulness, in its outer part, by an area of modified resonance, about one finger's breadth in width, to a point 2 inches from the mid-sternal line. Auscultation over the outer angle of the figure thus traced out revealed the heart sounds plainly audible.

The idea that the case was one of transposition of the heart was now strong, and so pointers of leaden wire were fixed to the skin at various points along the borders of the dull patch, and a skiagram was taken. The resulting negative showed a large shadow to the right of the spinal column, the ill-defined edges of which were fairly well indicated by the shadows of the leaden pointers. The left side of the chest was clear. The screen showed a very interesting condition of affairs; the dome of the diaphragm and its movements of respiration were clearly visible, whilst resting on it was seen the shadow of the heart, pyriform in outline. The diagnosis of transposition of the heart was completed by the clearness with which the regular contractions of the auricles and ventricles were noticeable on the screen.

This, then, was evidently a case of true congenital transposition of the heart, and not one of pathological displacement. The patient improved greatly, as to his pulmonary lesions, under treatment, and left hospital, invalided from the Service, early in July, 1906. The chief interest of the case lies in the rarity of the condition and the absolute proof of its existence by means of the X-rays.

CASE OF ASPIRATION OF THE LIVER FOR ABSCESS, WHICH WAS FOLLOWED BY AIR-EMBOLISM AND DEATH OF THE PATIENT.

By Lieutenant N. LOW.
Royal Army Medical Corps.

Gunner W., a thin, sallow-complexioned man, reported sick on May 8, 1906, complaining of pain behind the right shoulder. This had troubled him for the last week. He stated that he had not been feeling well for three months, without any definite symptoms, but had been losing weight for the last year, and thought he must have lost four stone. The temperature was then 100° F. There was no evidence of injury to the shoulder, and no pain or swelling. Evening temperature 102·2° F.

He was admitted to hospital on May 9th, 1906, the morning temperature being 99·6° F. On examination the following conditions were found: *Heart:* The sounds were normal, no valvular murmurs; the apex beat was 1 inch internal to the lungs. *Lungs:* The breathing was tubular below right clavicle; there was slight increase in vocal resonance, but no dulness. Breath sounds normal over the remainder of pulmonary region. *Spleen:* No enlargement or tenderness. *Bowels* were open. *Urine:* Sp. gr. 1020; no sugar or albumen; colour light yellow. *Blood:* There were no malarial parasites present. Blood count not made, but there was a distinct increase in the leucocytes. *Liver:* Dulness extended to the costal margin in front, and as high as the lower edge of the fifth rib.

May 9th, 1906.—The lower border of the liver could just be felt beneath the costal arch. The dulness behind extended up to the eighth rib in the scapular line. There was no pain and no tenderness on pressure over the liver. Evening temperature 102·8° F.

May 10th, 1906.—Morning temperature 100° F. Patient said he was quite comfortable with the exception of slight pain behind the right shoulder. The bowels were open in the evening. Tongue was thickly coated with dirty yellowish fur. Evening temperature 102·4° F.

May 11th, 1906.—Morning temperature 99·6° F. Patient was quite comfortable, and said he felt better. He had sweated profusely during the night. The liver dulness had increased to three fingers' breadth below the costal margin, but not in any other direction. Bowels open. Evening temperature 102·8° F.

May 12th, 1906.—Morning temperature 99·4° F. There was no pain or change. Evening temperature 101° F. It was decided to explore the liver on the following morning, and he was prepared for operation.

May 13th, 1906.—Morning temperature 99·6° F.

Treatment.—The patient was strictly confined to bed, his diet being milk, soda-water, eggs and puddings.

Medicinal.—Mist. sod. salicyl., ℥i., t.d.s., during 9th and 10th. Calomel, gr. i., podoph. resin, gr. ¼, in pill, every four hours, 11th, 12th and 13th. Fomentations over hepatic area.

Patient was taken to the theatre and anæsthetised with chloroform. He took the anæsthetic well. The skin having been disinfected I inserted an aspirating needle, 3 inches long, into the lowest intercostal space in the anterior axillary line, and pushed it on into the liver; instantly there was a loud hissing noise as of air being sucked in, and the patient's respiration stopped at once. There were one or two feeble pulse beats felt at the wrist, and then they stopped also. I put my thumb over the end of the needle to prevent further air entrance. When the air rushed in the right side of the patient's face twitched sharply for a moment, and his pupils widely dilated. His face turned livid. He never recovered in spite of artificial respiration, stimulation by the electric battery, and injections of strychnine and ether.

Post mortem, performed by Lieutenant E. T. Harris, I.M.S.—The thorax and abdomen being opened in the usual manner, it was perceived that the peritoneal cavity was full of blood—a pint and a half was collected and measured. *Heart:* The right cavities of the heart were filled with spumous frothy blood and air bubbles. With this exception it was normal. *Lungs:* Base of right lung slightly adherent to the diaphragm above an abscess in the right lobe of the liver. Otherwise lungs were normal. *Spleen:* Normal. *Kidneys:* Normal. *Intestines:* Normal. *Liver:* Weight 116 ounces, much enlarged. The needle puncture was in the right lobe, 2 inches above lower margin. There was a small blood clot adherent to the puncture. On cutting down upon a probe passed into the wound it was found that a large branch of the portal vein had been opened. On squeezing the liver frothy blood and air bubbles issued from this vein. The upper portion of the right lobe was occupied by an abscess, the size of a child's head, filled with whitish-creamy pus, and surrounded by a thick fibrous wall, about a quarter of an inch thick. There were 32 ounces of pus. Death was due to anæmia of the lung and brain, consequent to the failure of the heart to keep up circulation.

A peculiar feature of the case was the almost entire absence of any symptoms arising from such a large liver abscess. From the size of the abscess and thickness of the wall it must have existed for at least three months, during which time he went about his work and apparently had no symptoms beyond feeling a little "off colour." I have not heard or read of a similar case.

CASE OF ANEURYSM—LEFT INTERNAL CAROTID—WITH GLAUCOMA OF LEFT EYE.

By Captain J. MATTHEWS.
Royal Army Medical Corps.

History.—The patient was kicked by a horse on the left side of the head just above the zygoma on July 22th, 1905; he did not lose consciousness. About a week after the injury he developed a squint in the left eye which lasted a fortnight. In September, 1905, the patient noticed that

the eye began to get red, and at the same his vision became impaired. He was ordered to Secunderabad, and sailed for India on September 21st, 1905. On the voyage out he felt a buzzing sound, intermittent in character, in the left side of his head and face, most marked in the region of the zygoma. He did his duty for about three weeks in India, and was then sent sick by the medical officer of his unit owing to the congestion of the conjunctival vessels of his left eye. He was invalided home to England, arriving here on June 9th, 1906.

Condition on Admission.—Right eye: Normal, vision $\frac{6}{6}$. *Left eye:* Vision deficient; could only count fingers with difficulty at close quarters. Eye slightly prominent, pupil dilated and slightly oval, veins of conjunctiva swollen, tortuous, and purple in colour, with a purple zone in ciliary region.

Tension.—Greatly increased.

Fundus.—Disc capped right up to margin; vessels thin from compression, media clear.

Eserine was instilled into the eye, but the pupil only partially reacted to the drug.

Head Symptoms.—Patient complains of an intermittent buzzing sound in his head on the left side. No external swelling could be made out, nor could any pulsation be discovered on palpation. On auscultation a well-marked bruit, synchronous with the cardiac systole, could be heard over the pterygoid region, the lower part of the mastoid process, and the upper part of the posterior triangle. The bruit was not audible over the orbit, nor over the frontal or parietal bones, but could be heard slightly a little way above the zygoma. There was no sign of interference with the circulation in the vessels of the orbit, nor any bulging or throbbing of the connective tissue. The bruit could be stopped completely by compressing the common carotid. The patient said he had had no pain except in his eyeball, which he said had given him neuralgia. He was, as a matter of fact, restless and irritable; his pulse was rapid and greatly increased on exertion.

On June 20th, 1906, chloroform was administered and an iridectomy performed, the knife being entered well behind the corneo-scleral margin, and a large segment of the iris removed. There was a good deal of hæmorrhage at the time of the operation and the patient had recurrent attacks of bleeding into the anterior chamber during the following week. He was very restless and difficult to keep quiet.

On June 30, 1906, chloroform was again administered, and Major Holt, D.S.O., ligatured the common carotid at the level of the cricoid cartilage.

After he had got over the effects of the anæsthetic iodide of potassium was freely administered for a fortnight, when it had to be discontinued owing to its toxic effect on the pulse, which became feeble and rapid.

The patient made an excellent recovery after the operation. All trace of the bruit has disappeared and the patient says he can feel nothing of

the buzzing sound—in fact, he says he feels quite well. He is bright and cheerful, a state of mind that contrasts materially with his condition on admission. The vision in the left eye has improved and tension is normal.

A CASE OF INTESTINAL OBSTRUCTION DUE TO HYPERTROPHIC STENOSIS OF THE LARGE INTESTINE.

By Captain F. J. PALMER.
Royal Army Medical Corps.

The following case seems worthy of note, if only on account of the very unusual lesion disclosed by operation.

Sergeant M., 1st Worcester Regiment, was admitted to hospital at Templemore, on May 28th, 1906, with constipation of four days' standing, intestinal pain and vomiting.

Previous History.—One of constipation off and on for twenty years. Has had several similar attacks, but none as bad as the present one. States his age is 28, but looks older and is anæmic and cachectic. At first purgatives and enemata had no effect, and on May 19th he was in great pain, with marked distension of the abdomen, neither fæces nor flatus being passed per rectum. Morphia given hypodermically to relieve pain.

May 20th.—Passed a good night. Looks better. Distension less. A turpentine and soap and water enema acted well.

May 25th.—Discharged hospital. No evacuation without enemata. Ordered an aperient and carminative mixture.

May 31st.—Attending daily for enemata. Distension continues.

June 6th.—Still attending. States he is getting worse. Bowels acted on slightly by enemata.

June 16th.—Transferred to the Royal Infirmary. On admission the abdomen was enormously enlarged and tympanitic all over. The distension was nearly equal on both sides, though when first examined the right side was a shade larger, but on shifting of flatus the left side became the bigger. The course of the colon was marked out in both flanks by a rounded ridge more than a hand's breadth broad, and a similar belt connected the ascending and descending portions at the level of the umbilicus. No peristalsis was visible. Above the pubes a hard mass, most marked under the left rectus insertion, was felt, but owing to the great distension and hypertrophy and tenseness of the recti muscles, it was impossible to make out any more. Patient was spare, anæmic, and somewhat cachectic-looking, but there was no vomiting, and his condition was not immediately serious. The tongue was very little furred, and the pulse good and regular. He was placed on plain milk diet, and ordered 2 ounces of magnesium sulphate in saturated solution, which produced no effect.

June 17th.—Ordered enemata of soap and water 1 pint, with turpentine, one teaspoonful, twice daily. Scarcely any effect produced. Digital examination of the rectum showed it to be empty and slightly ballooned. No stricture could be felt, but the anterior wall seemed to be pressed somewhat inwards immediately below one of the usual rectal flexures. The projection did not feel at all like a new growth.

June 18th.—Enemata repeated four times daily, with little or no effect, but he states he feels a little easier.

June 19th.—As the smaller enemata seemed to produce no effect, enemata of soap and water, 2 pints, each containing 2 ounces of magnesium sulphate and a couple of teaspoonsful of turpentine were ordered three hourly, day and night, and 2 ounces of magnesium sulphate by mouth, given at 7 p.m., under the impression that fæcal impaction was the cause of the obstruction, although the possibility of a stricture alone, or in conjunction with the constipation, was not lost sight of, in which case the administration of purgatives by the mouth might help to clear the diagnosis.

June 20th.—Having received an urgent telegram the previous evening, I had to proceed to the Curragh by the morning mail, not coming back until evening. I found that on the previous night, after the administration of the saline by mouth, vomiting had been very severe, and that the pulse had run up from 66 to 102, with slight elevation of temperature and considerable weakness. The bowels had, however, begun to act well after each enema, and quantities of very foul fæces were passed in a fluid condition, with numerous small flaky scybalæ. Having got the bowels to move, it was determined to keep them so until they were completely emptied, and the enemata were repeated two hourly during the night, with the result that twenty-five motions in all took place within the twenty-four hours.

June 21st.—Enemata given, four hourly, to-day. At 2 p.m. and 8 p.m. an enema of one pint of olive oil given. Distension rapidly subsiding. Twenty-nine motions within the twenty-four hours, fluid, with flaky scybalæ, as before. Feels much better. Pulse 88.

June 22nd.—Pulse rate has fallen to 52. Much better. Distension almost gone. Enemata still continued four hourly, but no turpentine used. Motions, twenty-seven, fluid.

June 23rd.—Enemata stopped. Twelve fluid or semi-solid motions.

June 24th.—On palpating the abdomen this morning a hard tumour about the size of a cricket ball was felt under the left rectus, midway between the umbilicus and the pubes. The hardness above the pubes had disappeared. The mass could be freely moved from side to side and slightly up and down. Five minutes later the patient had made water and the tumour had disappeared, a mass being once more felt above the pubes. When the bladder again filled the tumour was again lifted out of the pelvis. No dinting of the tumour on sustained pressure could be

made out. Within the next few days, though still rising and falling with the distension and emptying of the bladder, the swelling tended to become slightly more distinct in the abdomen. On rectal examination, the rectum as far as could be reached was found empty, and the "tumour" could be easily palpated bi-manually through its wall. As the distension seemed now almost completely relieved, the diagnosis was thought to lie between a dermoid arising between the bladder and rectum, or a fibroma or fibro-sarcoma of the mesentery, the descent of which into the pelvis had caused the obstruction.

June 28th. *Operation.*—Chloroform. Major Healey, R.A.M.C., assisting. An incision was made from pubes to umbilicus to the left of the median line and almost directly over the swelling, and the left rectus displaced outwards. On opening the peritoneum, what was recognised as an enormous dilated colon, from its broad anterior muscular band, at once presented. This band was nearly 2 inches wide, and the colon was dilated to the size of the cardiac end of a large stomach, with greatly thickened walls. Only on long-continued firm pressure could the contents be dented in the lower part of the presenting bowl, whilst in the upper part it was easier to do so. In the middle of the distended bowel presenting in the wound was a narrow strictured area of cartilaginous hardness, and, unlike the rest of the bowl, white in colour from opacity of its peritoneal investment. Below it the intestine was again expanded to almost the same size as above the stricture, and filled with hardened fæces. The stricture was situated at the junction of the descending colon and the sigmoid flexure. The walls of the hypertrophied colon were subsequently found to be over half an inch in thickness, and all the blood-vessels of the meso-colon were greatly enlarged and its layers widely separated, as distension of the gut had taken place backwards between them. The bowel was pulled as far forwards as possible, and could be just brought outside the abdominal wall. Pylorectomy clamps were placed above and below the stricture, but would only go half-way across the distended bowel. The abdominal wound was packed off as well as could be, the bowel above the stricture opened by a 2-inch longitudinal incision through anterior band, and its contents, consisting of very foul pasty fæces, evacuated and squeezed into a basin, until the portion of bowel immediately above the stricture as far as could be reached was thoroughly emptied. A couple of silk retraction sutures were passed through the outer coats of the lower portion of the bowel below the distal clamp, and the bowel cut across between it and the sutures. These sutures when drawn upon served to keep the gaping lower end of the bowel a little above the level of the parietal incision. The hard contents of the bowel below the stricture were dug out with a spoon, and in this manner a complete evacuation of the distal loop as far as could be reached obtained. In spite of careful packing and frequent changes, considerable soiling of the parietal wound

and of the peritoneum was inevitable, though it was endeavoured to minimise it as much as possible. The stricture was then excised by cutting across the bowel above the upper clamp. The portion removed was wedge-shaped, being broader at the free than at the meso-colic border, but a similarily shaped piece of meso-colon could not be removed, as, owing to wide separation of its layers, the blood distribution of the divided ends could not be satisfactorily traced, and it was feared that the vitality of the suture line might be endangered. The lumen of the upper bowel, which was more freely movable than the distal portion, was then irrigated and washed out, and the edges of the lower portion cleansed with swabs wet with saline solution; the packing round the wound replaced by fresh, and end-to-end anastomosis begun by Czerny-Lembert suture. The first suture, which began in the middle of the space behind which was bare of peritoneum, involved the mucous and fully half of the thickness of the muscular coat. It was a continuous one, being interlocked about every fourth stitch, and the silk used was much stouter than that usually employed for intestinal work. It was thought that finer silk would more readily cut out under the influence of intestinal peristalsis in such a hypertrophied bowel. As the suture approached the point from which it started it was found that the upper portion of the bowel was somewhat the larger of the two, but by leaving a wider interval between each stitch above than below, the ends were approximated without any undue puckering at one spot. A few additional sutures were placed here and there in the portion of gut uncovered by peritoneum, as this was likely to be the weak spot of the suture line. The bowel was then once more irrigated with hot saline, and a continuous Lembert suture, interlocked every fourth or fifth stitch, run outside the previous one. This suture was also of stouter silk than ordinary, and involved the outer half of the muscular coat as well as the peritoneum. As the suture approached the bared space behind, the layer of the meso-colon corresponding was picked up widely and forced into service. Owing to the rigidity of the thickened coats of the bowel the inversion obtained was anything but complete, but proved adequate; and for this reason also the amount of tissue picked up in both inner and outer layers of suture was much thicker than usual. The bowel was again irrigated and returned to the abdomen, which was then washed out with saline solution, and saline containing 10 minims of solution of adrenalin chloride, 1 in 1,000 to the pint, left in the peritoneal cavity as a restorative. The peritoneum was sutured by a continuous catgut suture, a rubber drainage tube ran into the pelvis, and the rectus allowed to resume its position, after which its anterior sheath was united by kangaroo tendon. The skin was united by a continuous suture of silkworm gut, and the wound dressed with iodoform gauze. The patient did not seem much affected after a prolonged operation, but was given a rectal hot saline injection before leaving the

theatre. This was repeated at 10 p.m. and 4 a.m next morning, with the double object of alleviating thirst and facilitating toxin elimination. Warm water in ½-ounce quantities was given hourly after the operation. I saw the patient at 6 a.m. the next morning, on my way to the Curragh, whither I had been called by telegram, and found him surprisingly well, though in some pain and very weak. He had slept a little at intervals during the night, and had had no vomiting. A fair quantity of urine had been passed naturally.

June 29th.—Peptonised milk, ½ ounce, allowed hourly after mid-day, and hot water in ½-ounce quantities as thirst required, also a little Valentine's meat juice. Temperature, morning 100° F., evening 100·6° F. Pulse, morning 104, evening 114; good volume. Moderate pain. Urine free and passed naturally. The wound was dressed during the day, and some slightly turbid blood-stained serum sucked out of pelvis by pressing a finer tube attached to a syringe down the drainage tube which had been left in the pelvis. The head of the bed had been well raised on blocks to facilitate drainage downwards.

June 30th.—Temperature, morning 99° F., evening 99·4° F. Pulse, morning 110, evening 106. Little pain except when wounded intestine contracts, when intense griping occurs. This took place frequently, owing to passage of flatus through sutured area, which was subsequently expelled almost entirely per anus. From midday he was given alternate hourly feeds of 1 ounce and ½ ounce of peptonised milk respectively. Warm water freely given. Slept fairly well. Clear bloody serum aspirated on dressing.

July 1st.—Temperature, morning 99·4° F., evening 101·2° F. Pulse 104 and 100. Severe griping pain from flatus expulsion. Rectal tube passed, but did not relieve him very much. Very tender over wound. No fluid on aspiration of drainage tube, which was probably kinked by flatus-distended intestine, and down which the fine tube could not be passed. Slept fairly well after ⅙-grain of morphine at 11.45 p.m. Feeds as before.

July 2nd.—Temperature, morning 99·4° F., evening 100·8° F. Pulse, morning and evening, 88. Pain still severe. Drainage tube removed to-day and a small gauze plug passed a short distance along its track, in case the peritoneal cavity were not completely shut off from the external wound. Feeds as before, but beef tea and raw meat juice now being given in small quantities; ⅙-grain of morphine given at night, but did not sleep well.

July 3rd.—Temperature, morning 99·6° F., evening 100·4° F. Pulse, morning 78, evening 80. Had two slight natural motions during the day and slept well after morphine at night.

July 4th.—Temperature, morning 98·6° F., evening 100·8° F. One and a half ounces of plain milk given hourly, with one ounce of beef tea

at similar intervals. Twenty-four ounces of urine passed. Slept well after morphine.

July 5th.—Temperature, morning 99·8° F., evening 102·8° F. The pain over abdominal wound, with rising temperature, suggested suppuration of the parietal wound; the neighbourhood was slightly swollen. No abdominal fæces. A soap and water enema given during the day retained. Morphine at night.

July 6th.—Morning temperature 101° F. A discharge of fæcal-smelling pus in large quantity came from the parietal wound at the spot where the drainage tube had been inserted. On dressing, the skin suture was removed and the skin found united in the whole length of the wound, though from the point at which the drainage tube had been inserted a probe could be passed a long way upwards immediately beneath the skin. The evening temperature was 99·6° F., and he never gave any more anxiety. The malodorous pus discharge lasted in decreasing quantity for more than a week, until the infected kangaroo tendon sutures had been absorbed, but as they had apparently lasted long enough to attain their object of keeping the edges of the wound in the rectal sheath in apposition, it was not considered necessary to re-suture the abdominal wall. The subsequent progress was uneventful. He was gradually placed on ordinary diet, and gained rapidly in weight and strength, being allowed up on July 20th. The bowels continued to give slight trouble, as though occasional spontaneous movements took place. As a rule medicine was required, castor oil or magnesium sulphate proving the most efficacious. The difficulty with the bowels was apparently due to arrested peristalsis at the site of suture, as, though no pain or discomfort was experienced after the first fortnight, about a month after operation a piece of the inner silk suture was noticed protruding from the anus after a motion. Seven or eight inches were cut away and the remainder became subsequently withdrawn into the bowel. On August 9th the suture had not yet been cast off, and as it was necessary to obtain a deep hold of the muscular as well as the mucous and submucous coats, its extrusion by ulceration will probably be a slow process, each stitch leaving a cleft to heal, the irritation of which must tend to inhibit peristalsis in the neighbourhood of the wounded area.

August 11th.—Discharged hospital and granted a sick furlough. During the past week the bowels have on several days acted without medicine, and he has gained 7½ lbs. in weight.

March 3rd, 1907.—Reported himself to-day for inspection, being over eight months from date of operation. States suture came away three weeks after leaving hospital. He has been performing his duty for six months, and appears stout and in excellent health. He has been eating ordinary food since leaving hospital, and as a rule has a natural motion daily, but every three or four weeks becomes somewhat costive and flatulent, and then finds that a single dose of salts followed by a hot drink

produces a good evacuation in a few hours and makes him all right again. On a few occasions this purgative has produced pain, but generally does not do so.

An examination of the stricture after removal showed it to be annular in character, and covered by practically intact mucous membrane. The circular and longitudinal muscular coats were greatly hypertrophied, and both to the naked eye seemed to have undergone a colloid change. The stricture admitted the tips of two fingers, and seemed to be caused by an annular hypertrophy of the circular coat, which formed a sort of raised collar projecting into the gut and narrowing the lumen. On microscopic examination there was no sign of recent or old ulceration, and the mucous membrane at the site of the stricture showed normal crypts of Lieberkühn except at one spot, opposite the meso-colic border, where the appearance was that of an extremely early stage of columnar carcinoma, some penetration of the muscularis mucosæ having begun over one spot about a quarter of an inch square, but this was apparently only a secondary change, most probably due to irritation. The muscular coats recalled the appearance seen in fibrous myocarditis, each involuntary muscle cell being separated from its neighbour by a marked overgrowth of connective tissue. "Hypertrophic stenosis" would most accurately describe the appearance presented.

Comment.—The following points are of interest in the foregoing case:—

(1) The difficulty in diagnosis leading to an uncertainty scarcely creditable, but perhaps inevitable.

(2) The rare nature of the lesion present. I have been unable to find in the ordinary text-books any mention of hypertrophic stenosis of the colon. As is well known, this condition is fairly common at the pyloric orifice, and as such is always congenital; in all probability the lesion present in this case was also congenital, and the clinical history and marked hypertrophy present favour this view.

(3) The tolerance of the healthy peritoneum to a considerable amount of infection is no new discovery, but has been emphasised by many writers. It was well shown in the present case, in which the wound in the abdominal wall suppurated, whilst no trouble arose from the peritoneal soiling which must have occurred during operation.

(4) One cannot help being struck by the similarity in the clinical picture and history to the second case, ascribed to enterospasm, by Dr. Hawkins, in an article in the *British Medical Journal* of January 13th, 1906. The stricture in the present case was due to the narrowing of the lumen of the bowel by a hypertrophy and sclerosis of its muscular coats. Is it possible that in such a lesion we have the terminal state of the extremely interesting condition described by him as enterospasm, and which may possibly be due to perverted nerve influence?

Travel.

HOW THE NATIVES OF THE BRITISH EAST AFRICA AND UGANDA PROTECTORATES ARE MEDICALLY PROVIDED FOR DURING THE EARLY STAGES OF THE OPENING UP OF THESE COUNTRIES.

By Quartermaster-Sergeant R. STANLEY.
Royal Army Medical Corps.

In latter day periods of advanced and civilised countries it is not an uncommon observation, "I wonder how they managed to do these things in olden times," and the sciences of medicine and surgery, as practised nowadays, command such observation as frequently, perhaps, as any of the other applied arts to the every-day requirements of man. Now in these Protectorates, the varied tribes of which are only emerging from barbaric and most primitive customs, and the light of Christianity and civilisation only gradually dawning on their bewildered and limited imaginations, it may prove interesting to place on record how these vast territories, or as much of them as have been opened up by or come into touch with the white man, are medically provided for in their early civilising history, and with this object in view I propose giving a brief description of present day arrangements and some of the difficulties besetting them.

The two chief sources administering much needed medical aid and battling with the scourges of pestilential diseases amongst the natives of these Protectorates are of missionary and Government enterprise. The many dialects of the Bantu tongue spoken by the various tribes are so dissimilar, that adjoining tribes cannot understand each other, and herein, it would appear, lies the greatest difficulty experienced by medical and partially trained medical men and women desirous of contributing to the abatement of the many forms of disease prevalent amongst these wild peoples, by reason of the difficulty in providing persons possessing a knowledge of these dialects. In many ways, of course, a great many diseases are obvious, but even then the difficulty arises in explanation and persuasion of the necessity for certain treatment, with probable isolation and prevention of contact with others, to limit spread of disease. The native is invariably eager to secure treat-

ment from the white doctor, and rightly, of course, to his untutored mind, the latter is held to possess extraordinary powers for the relief and cure of ailments, but it has to be made evident to him why every condition exacted is necessary to obtain his acquiescence. It may safely be asserted, that where a minister of religion may fail in his efforts to Christianise, the doctor will be usually successful; hence of late years it has been the custom to send amongst these tribes religious men, not altogether unpossessed of some medical training, by the Church Missionary and other evangelistic societies interested in the reclamation of barbarous peoples to Christianity. I believe that at present in England there is a medical college purposely maintained by these Christian societies, where intending cleric and lay missionaries are taught hygiene and preventive medicine, so as to more fully equip them for their future missionary labours. Many missions are provided with doctors in addition to ministers of religion, but financial considerations only rarely permit of this expensive provision. In justice it must be admitted, before giving details of Government medical arrangements, that the medical, industrial, and religious workers in missions (I mention them in the order of merit I personally consider them) deserve all credit for the good work they perform, without any assistance from Government funds, and little personal remuneration to themselves except that of the self-satisfaction derived from the high and noble calling to which they devote their lives, and also for the generous and loyal help they ever readily give the Government medical department on all occasions, particularly in communicating any unusual or serious outbreak of disease, and thereby rendering investigation easy.

The Government medical department for the two Protectorates is combined, and administered by Lieutenant-Colonel J. Will, R.A.M.C., Principal Medical Officer. The *personnel* of the department is as follows: 1 Principal Medical Officer, 1 Deputy Principal Medical Office, 1 bacteriologist, 24 medical officers, 8 temporary medical officers (for investigation of sleeping sickness), 7 medical dispensers (European), 7 lady nurses (European), 1 medical storekeeper, 1 chief clerk to Principal Medical Officer, 4 assistant surgeons (Indian trained), 15 hospital assistants (Indian trained), 24 compounders (Indian trained), 200 native attendants as dressers, ward servants, sweepers, &c.

Native hospitals or dispensaries to the number of fifty-two are established throughout the Protectorates (sixteen of which are in Uganda). It is unnecessary to enumerate the various stations where

these exist, but some extent of the territory may be realised by a glance at the map of Africa, and along the line of which (*via* Uganda Railway), from Mombasa on the coast to Lake Victoria Nyanza, thence to Gondokoro on the Nile, medical outposts are to be met. It is not possible to provide medical officers for all stations, and consequently the only medical aid available at many is that of an Indian hospital assistant or Indian compounder. The trained and certificated Indian is a very useful man, and competent, from his training, to render valuable assistance in the case of disease or injury amongst the natives, and many white traders and settlers have had occasion to be grateful to him for timely services rendered. The work at isolated stations is heavier than might be imagined, and from twenty to fifty cases may be dressed, treated, and prescribed for daily by the assistant, while at larger stations, with increased native populations, and where a medical officer with necessary staff is quartered, the day's work invariably proves a heavy one.

The language difficulty of conversing with the native is overcome either by an acquired knowledge of the local dialect or by interpretation, the latter chiefly through the Ki-Swahili language. A fair knowledge of Ki-Swahili is a necessity, and will prove sufficient to take one through any opened up territory, where the Swahili and others possessing a knowledge of this tongue, such as the Somali and coast Arab, are usually to be found, and in some cases are officially employed as interpreters. The Indian assistants and compounders are quick in attaining a knowledge of the more common phrases in the native dialects, particularly such as appertain to the investigation and treatment of illness.

Where dispensaries only are established, the natives attend for treatment and afterwards return to their grass huts, but should disease prove in any case to be contagious, the local administration officer or collector is informed, and arrangements made for the speedy erection of a hut to isolate the case. The scale of dietary of the sick is that of their every day subsistence (unless illness warrants special supervision in this respect) and is provided by the patient, his relatives or friends. Sweet potatoes, mtama flour, beans, bananas, mealies, milk and honey, constitute the chief articles of diet of the African of these parts, and some tribes possess a fancy for meat, whilst others reject it.

Epidemic diseases in the form of small-pox, plague and sleeping sickness have played havoc and decimated tribes in the past, but the advance of civilisation and science must undoubtedly check

these ravages in the future. Great difficulty is experienced in inducing the native to submit to vaccination or any preventive inoculation, and no small amount of conviction and tact requires to be exercised to obtain any appreciable consent numerically. It is hoped to establish a vaccine farm at Nairobi during the present year which will meet the lymph demands of both Protectorates.

A headquarter store for the distribution of medicines, surgical and medical materials and appliances, medical comforts, &c., to all hospitals and dispensaries, is established at Nairobi, with smaller stores at Mombasa and Entebbe to meet intermediate and urgent demands from coast, Nile and inland Uganda stations respectively. Half-yearly supplies as indented for are despatched to all stations from the headquarter store, and where transit is not possible by rail or steamer, supplies have to be packed in loads not exceeding 60 lbs. for transport by native porters.

Hospitals for Europeans are established at Mombasa, Nairobi and Entebbe, each with a staff of one medical officer, two European nurses and a complement of native menials. These hospitals are primarily intended for sick Government officials, who pay a daily fee whilst under treatment, according to salary, but European traders and settlers requiring and desirous of admission are treated and dieted, a fee of five rupees being charged for each day in hospital. The scope and work of the medical department increases yearly owing to new districts being opened up and the establishment of Government stations, for which medical aid must be provided.

It will, I think, be admitted, that from a medical point of view the natives of these Protectorates are generously considered, particularly when it is remembered that the contribution from the British Treasury for all administration purposes amounts to over a quarter of a million pounds sterling per annum, a goodly sum of which is apportioned for medical expenditure. The hope to be expressed, therefore, is, that these countries will one day be self-supporting colonies, with an abundance of British settlers and loyal and grateful native populations, proving another valuable asset in the mother country's many oversea prosperous dominions.

Reviews.

AIDS TO DENTAL SURGERY. By A. S. Underwood, M.R.C.S., L.D.S.Eng., and Douglas Gabell, M.R.C.S., L.D.S.Eng. Second Edition. London: Baillière, Tindall and Cox, 1907. Price 2s. 6d., cloth.

This little book, "Aids to Dental Surgery," is an excellent epitome of the theoretical portion of that subject, and appears to be a condensation of that well-known work, "Diseases and Injuries of the Teeth," by Smale and Colyer, published by Longmans and Co.

The book is not divided up into chapters, but under headings, which are practically the same as chapters. The section or chapter on "The Hygiene and Care of the Teeth and Mouth" is a useful one, and the subject is well condensed. The section on "Abnormalities of the Temporary Dentition" contains a useful epitome of the process of teething, and in this connection the following passage occurs: "The diseases arising from difficult dentition have been very much exaggerated, and much harm has been done by attributing to teething, symptoms which should have led to the diagnosis and treatment of co-existing and more important diseases, such as rickets and gastro-enteritis." This statement is only too true, and is well worth bearing in mind by those who have not studied dental surgery. A great many general practitioners when called in to attend a case which they are unable to diagnose, occurring at the period of teething, at once attribute the symptoms to teething, and this diagnosis is exceedingly popular, because it generally falls in with the ideas of the mother of the child and pleases her. Under the heading "Abnormalities of the Permanent Teeth," the classification of odontomes, p. 28, is exactly the same as that given by Smale and Colyer. There is nothing new suggested to account for the irregularities in the positions of the teeth; the suggestion of selective breeding as a cause is doubtless obtained from the well-known work of Mr. Tomes, "A System of Dental Surgery," who was, it is believed, the first to point this out. This subject, of course, demands a more thorough investigation than has yet been accorded to it. Even in a small book like this, mouth-breathing is brought forward prominently as a cause, and on pp. 31 and 32 the following statement occurs: "Mouth-breathing is frequently associated with an irregularity of the teeth, and it may be that both abnormalities are the result of a common defective development, or mouth-breathing giving the nasal cavities no use, and so leading to their lack of development, may involve the adjoining parts of the palate and maxillary bones also, or the lack of air pressure in the nose may suck up the roof of the dental arch, or the mouth being open, and therefore the tongue pressure being removed from the inner side of the teeth, whilst the cheek pressure is increased on the outer side, may lead to narrowing of the arch. Probably all these forces help." In these days of physical culture a great deal has been written on mouth-breathing and its bad effects, and it appears most probable that the explanation given above is a correct one, and that nasal breathing is even far more important for children than it is for adults.

The chapter on Caries puts forward in a few words all that is at present known of the etiology of this important subject, but, as stated, does not attempt to teach the operative treatment; this, of course, would require a special volume. No less than twenty pages are devoted to the important subject "Periodontitis," which has been fully dealt with, embracing all that is generally known on this matter. The differential diagnosis between periodontitis and pulpitis, which is sometimes very difficult, is concisely described. The section on the Extraction of Teeth well describes *when* a tooth should be extracted, and the various complications which may arise during and after an extraction.

Considering the size of the book, it contains a vast amount of information, and would be most useful to any one preparing for an examination after having first read one of the larger books, such as "Diseases and Injuries of the Teeth," by Smale and Colyer. The surgical injuries and diseases of the jaws and mouth are also dealt with at the end of the book, but of course only briefly in a work of so small a size.

B. W. Longhurst.

Notes on Blood Serum Therapy, Preventive Inoculation, and Toxin and Serum Diagnosis. For Veterinary Practitioners and Students. By W. Jowett. London: Baillière, Tindall and Cox, 1907. Pp. 204. Price 5s.

The title of this excellent little book sufficiently explains the purpose of the author, and we imagine that it will prove of the greatest service to all who have to deal with disease in animals. It appears to be quite up to date, and the information given is very clearly put and systematically arranged. The rapid development of methods of immunisation, in accordance with the teachings of recent scientific work, has, as we know, a wide application in the case of disease of man; it is evident from Mr. Jowett's book that veterinary science is in no degree behind in availing itself of the weapons thus offered in the fight against diseases of animals. Although intended chiefly for veterinary practitioners and students, there is much in the volume that will prove of great interest to students of bacteriology, and all who are interested in the subject of immunity.

The author concludes with an interesting account of a Spirochæta which he finds in cases of equine "canker" and "grease," and which he considers as the probable cause. To judge from his description and figures the organism presents many special points of interest, and a detailed investigation of it might serve to throw further and much needed light on the vexed question of the biological position of these mysterious organisms.

The Nature and Treatment of Cancer. By John A. Shaw-Mackenzie, M.D.Lond. Fourth Edition, Revised. London: Baillière, Tindall and Cox, 1906. Price 2s. 6d. net.

We recently received a previous edition of this very interesting little book; the fact that two fresh editions have been called for in so short a time points out the importance of the subject better than can any recommendation of ours. The book is written for the use of those who have the care of inoperable cases of malignant disease; it offers suggestions for the amelioration, if not cure, of these most anxious and trying cases, where one invariably feels almost helpless as well as hopeless. There is

one omission we much regret, viz., any reference to Coley's fluid; the present available supply of this substance is claimed to be much more efficacious than that which some of us may have tried without success a few years ago, and certainly some quite recent results have been so far encouraging that we would have welcomed any observations by Dr. Shaw-Mackenzie.

M. P. H.

GLIMPSES OF AMERICAN SURGERY IN 1906. By C. Hamilton Whiteford, M.R.C.S., L.R.C.P. London: Harrison and Sons, 45, Pall Mall, 1906.

This is a little book of only 59 pages; we almost wish it had been twice that size, it is so full of interesting observations, so tersely stated, that we would gladly have had more; there is not a page without several useful little hints.

Of much interest to officers of the Corps is a statement that in Pennsylvania Hospital "during the past few years over sixty cases of perforated ulcer (in enteric fever) have been operated upon with about 24 per cent. of recoveries." The author visited a number of American surgical clinics, and under each he sets down a number of special points as observed there. This is just what makes his all too short note-book so entertaining. Many of the things he saw, however, are old continental friends, but it is not claimed that they necessarily originated in America.

M. P. H.

Current Literature.

Dr. Koch's latest work on Sleeping Sickness in Africa.—In a special supplement to the *Deutsch. Med. Wochenschrift*, No. 51, dated December 20th, 1906, a report by Geh. Med.-Rat Professor Dr. Robert Koch is published. The first part is dated Amani (German East Africa), June 10th, 1906. From here he proceeded *via* Mombasa and the Uganda Railway to Muansa at the south end of the Victoria Nyanza. Here he examined some 2,093 natives for trypanosomiasis from all parts of the town of Muansa, which has a population of about 8,000. He used the gland method of diagnosis. Out of the total, 42 persons were found to have swollen glands in the neck. Gland puncture was done in 33 of these, but trypanosomes were not found in any. From this and other observations Koch inclines to the opinion that this neighbourhood is up to the present quite free from endemic sleeping sickness, and the few scattered cases come without exception from English territory. He finds the *Glossina palpalis* widely distributed in German East Africa. The danger of the "belt" becoming seriously infected is considered. Koch, therefore, made some observations on the habits of the fly here. He found it most plentiful on ambatch vegetation. He states "that the *G. palpalis* is most abundantly found near water where crocodiles are present, and that they feed on the blood of these animals." He found the blood of crocodiles in the stomach of flies caught. He states "that the skin between the scales of the crocodile is quite thin and soft." He

examined the stomach contents of 228 flies here and found in 39 of these (17 per cent.) two varieties of trypanosomes, not *Trypanosoma gambiense*. These were probably *T. grayi* and *tullochii*. He surmises that the crocodile may be the host of these trypanosomes, but this point will be further investigated.

As there were few cases of sleeping sickness in German East Africa Koch accepted the invitation of the Commissioner of Uganda, H. Hesketh Bell, Esq., to proceed to the Sesse Islands in English territory. On October 15th, 1906, he reached the Sesse Islands, where abundant material, both cases and flies, were found. He utilised the Church Missionary Society's deserted house as a laboratory. Koch states "that from October 1st, 163 gland punctures had been performed and trypanosomes found 160 times. This result furnishes, therefore, a complete confirmation of the observations of the two English scientists, Greig and Gray, who discovered this method of diagnosis and strongly recommended it. As a result of their investigations they come to the conclusion that, in a region where sleeping sickness occurs, the presence of enlarged glands in the neck is a certain sign of the disease. With this all our observations are in complete accord, since we have found trypanosomes not only in the glands of those who report sick, but in those who appear quite healthy. Taking the gland enlargement as a certain sign of sleeping sickness, it is seen that the condition of the population of Sesse Islands is bad, 60 to 70 per cent. being infected with trypanosomes."

He considers that the only hope appears to be in the use of some drug acting like quinine in malaria. Dr. Koch employed atoxyl (a combination of arsenic); he injects it subcutaneously. Examination of the gland-juice after the injection showed that the trypanosomes had disappeared. He considers that it may be necessary to repeat the injections at intervals of seven days for about two months or longer. After injection he noted the effects on the trypanosomes by puncturing the glands from time to time. The result showed that up to six hours the trypanosomes were still unaltered; six to eight hours, they were scanty and irregular; after eight hours they could not be detected. Very similar results were obtained with ordinary arsenic in cases of sleeping sickness by Greig and Gray (Royal Society's "Sleeping Sickness Report," No. 6).

In his concluding report, dated Sesse, November 5th, 1906, Koch states "that he was then treating over 900 sick. In two or three months, according to my calculation, we will be so far advanced that, in the majority of our sick, the cure will be finished. We must, however, watch the patients for a similar period to note whether or not a relapse occurs. Only when we have determined certainly that the healing after the exhibition of atoxyl is permanent can we consider the problem solved. Then the prophylaxis of the plague lies to hand in the curing of the patient."

In continuation of the above, Koch publishes a second report in the *Deutsch. Med. Wochenschrift*, No. 2, January 10th, 1907. This report is from Sesse, Uganda, dated November 27th, 1906. He states that 907 cases of sleeping sickness are undergoing treatment with atoxyl at his camp. The Queba (Chief of Sesse) has built shelters for the accommodation of the patients. As regards the progress of the work he says: "The first point to mention is the diagnosis of trypanosomiasis; the results of

the gland-puncture mentioned in my last report have been further confirmed by later experiments. Since that report 190 gland-punctures have been made and 184 times the trypanosomes were determined. We have performed 356 punctures up to date and have had 347 positive results. As is to be expected, with growing experience and practice the results will improve, so that by correct choice of case the trypanosomes will, almost without exception, be determined. Since the trypanosomes are so regularly found, the view is correct, that this symptom is the most constant in trypanosomiasis (Greig and Gray); unlike the appearance of trypanosomes in the blood the occurrence of trypanosomes in the glands is not subject to great variation. In this respect the gland discovery obtains a high significance. It is not only of importance for the diagnosis, but it supplies a certain means for judging the effect which various methods of treatment have on the disease."

For the purpose of his atoxyl treatment Koch divides the cases into two categories: (1) The slight, *i.e.*, cases in the stage of adenitis; (2) the severe, *i.e.*, cases showing adenitis plus signs indicating involvement of the nervous system. In the slight cases he states that distinct amelioration of the symptoms follows the administration of atoxyl. The rule is that they lose their symptoms of headache, pain and the swelling of the glands diminishes. The effects on his severe cases may be illustrated by quoting two of his cases:—

No. 236 (Bugalla), T., man, aged 30. Catechist in the French Mission. Ill for two years; unable to walk for last six months. In a condition of sleep for last three months. On admission, September 11th, helpless and senseless. He lay in deep sleep. Passed his urine and fæces under him. When shaken he opened his eyes for a few minutes, yawned and fell asleep again. Now he has completely lost the sleepiness and enuresis. He is fully conscious; can walk well. He speaks quite intelligibly. Can read aloud from a book. Improvement is progressive.

No. 527 (Bugalla), D., man, aged 32. Sick for two years. On admission, October 15th, very weak, so that he is unable to walk. Subnormal temperature; pulse very frequent and scarcely perceptible. For three months passed his motions under him. Very emaciated and sleeps continuously. He still sleeps a good deal, but does not pass his motions under him. He can now walk with the help of one person; formerly he required two. Mind clearer; pulse slow and strong; temperature normal.

Koch considers that these cases of the second category will never be more than invalids, as the damage already done to the nervous system is so great; but from the point of view of the prevention of the disease this does not matter, as the trypanosomes in them have been destroyed.

Since the last report Koch is able to state that the patients remain for thirty days, and in some cases for forty days, free from trypanosomes in the glands after the last injection of atoxyl.

Koch confirms a view arrived at by Greig and Gray, in regard to the action of arsenic (Royal Society, "Sleeping Sickness Commission Report," No. 6), that the drug (atoxyl) kills off the trypanosomes, and that these dead trypanosomes act as immunising agents.

He states that this method of treatment could be carried out on a large scale without difficulty. He thinks that the procedure may be further improved, and a single, instead of two injections of atoxyl, will be sufficient to completely destroy the trypanosomes.

As regards his other work: in examining a number of *G. palpalis* he has been able to discover the presence of trypanosomes in the salivary glands (observation previously made by Gray and Tulloch, of the Sleeping Sickness Commission of the Royal Society, Report No. 6). He is of opinion that it would be useless to use this method (the examination of salivary glands of flies) as a means of determining the presence of trypanosomiasis in a district, as the examination of infected individuals by the gland method is much simpler and more accurate. He has not been able to make any further observation on crocodiles.

The future reports of Professor Koch will be looked forward to with interest. How far atoxyl will prove to be an advance on arsenic in the treatment of trypanosomiasis remains to be seen.

E. D. W. GREIG.

On the Life-history of the Stable-fly (*Stomoxys calcitrans*, Linn.).—IN a recent issue of the *Journal of Economic Biology*,[1] Mr. R. Newstead, of the Liverpool School of Tropical Medicine, has given a full and detailed account of this blood-sucking fly, together with a series of drawings illustrating the eggs, larval details and puparium. The subjoined notes and abstracts give the main points, as set forth by the author:—

"Farmyards and stables are evidently the favourite haunts of this fly; it occurs also in the fields, parks and open woods, especially where cattle are grazing, but is much less numerous in such places. It is evidently also by no means uncommon in some of our large towns. . . . It is fond of resting on surfaces fully exposed to the sun, such as doors, gates and rails, and, to a less extent, also on stone and brick walls. They are very active, but their flight is quite inaudible at a short distance, the noise produced being very feeble. When disturbed they frequently return to the same spot, but more especially so in favourite resting-places. At night they retire to some sheltered spot, and numbers may be found at rest on the beams and rafters in open sheds in farmyards, where they remain, almost inert, till the morning sun tempts them out again. They will also occasionally enter stables in the daytime, and they were seen to enter such places through a narrow opening or crack in the door.

"When at rest the front part of the body is often slightly raised, but not invariably so; and the wings, which touch at their bases, are widely divergent and carried in a horizontal position, lying practically in the same plane as the abdomen."

During the heat of the day the ratio of the sexes was about three males to one female, but towards evening the sexes occurred in about equal numbers. The flies are most abundant during August and the early part of September, but they also occur in smaller numbers throughout the month of October, especially on warm sunny days, and an odd specimen was seen during the first week in November.

The author has proved that the blood-sucking habits of this fly is not a peculiarity of the female alone, as a freshly emerged male readily sucked blood from his own hand. In captivity the flies also fed upon the fresh fæces of the horse and sheep, and one was seen to suck up the juices from a dead companion. "Three specimens fed upon some sugar

[1] Vol. i., part 4, pp. 157-166; pl. 12, figs. 1-8 (1906).

and water, and some also sucked up the moisture from a decayed and fœtid potato." When in the act of sucking blood "the whole of the proboscis was straightened and held vertically, and the anterior third was driven into the flesh. During the process, which lasted altogether for a period of fifteen minutes, the proboscis was constantly, but somewhat slowly, moved up and down, and also with an occasional semi-rotary movement, reminding one somewhat of the action of a quarryman's hand drill. This action was continued until this fly had pumped its body full of blood. The initial pain was trifling compared with that of a mosquito, but there were two subsequent pricks which were quite as irritating as the first. A small drop of blood was left over the puncture, and when this was washed away a small roseola was revealed, but there was no subsequent irritation or soreness of any kind. A clear fluid was passed from the anus four times during the process, and on several occasions subsequently, and judging from the size of the abdomen the food was rapidly assimilated. This fly died twelve hours after feeding."

In the process of egg-laying the ovipositor is fully extended and the eggs are passed down at intervals of from five to thirty seconds, and in captivity are usually laid in an irregular heap. In some instances the female was seen to separate the eggs by carefully passing her proboscis between them, and then drag them away or scatter them with her legs. Counts were made of seven batches, the maximum being seventy-one, the minimum forty-eight.

"The egg is white at first, but soon changes to creamy-white. . . . Form very elongate, shaped somewhat like a banana, being curved on one side and almost straight on the other, the straight side with a broad, deep groove, which widens at the anterior end, giving it a spatuloid form. Surface with faint polygonal reticulations. The larva effects its escape by splitting the broad end of the groove, leaving it slightly raised and apparently intact on the opposite side." Incubation period two to three days. Length, 1 mm.

The larva is "creamy-white to pale ochreous, translucent, shining and almost glass-like; subcutaneous mouthparts black; the convoluted alimentary tract when filled with food gives the posterior half a blackish or greenish-black colour; tracheal tubes forming two submedian white lines and delicate lateral branches; posterior stigmata black; thoracic stigmata ochreous. Form long, tapering to a point in front, widely rounded posteriorly. Segmentation not very pronounced." It is therefore of the ordinary muscid type and somewhat resembles the larva of the common house-fly (*Musca domestica*).

In captivity the larval stage lasted from fourteen to twenty-one days, but the absence of excessive moisture and the admission of a little light materially retarded their development, which then extended over a period of from thirty-one to seventy-eight days, and some did not pupate before the winter set in. Larva reared under these conditions produced flies much below the average size.

The pupa or puparium is of the ordinary barrel-shaped type and of a bright terra-cotta red, changing to dark chestnut-brown before the emergence of the fly. This stage lasted from nine to thirteen days. Length 5 to 5·50 mm.

On emerging from the puparium the fly is dark grey in colour, the

head wider than the thorax, and the abdomen much attenuated. Its subsequent development is extremely interesting, and there are three well-marked stages :—

(1) An active stage, which lasts for about half an hour, in which the insect devotes nearly the whole of its attention to the escape from its larval environment, and by the aid of its frontal sac, which it constantly inflates, and the use of its legs, it is able to force its way through a thick layer of material (fæces, &c.) into the open air.

(2) In this stage the frontal sac is contracted, the fly becomes quiescent, air is pumped into the body, the fly increases in size and finally the wings are rapidly developed.

(3) The proboscis is raised from the ventral to its normal position; the wings and integument gradually harden, and the insect takes flight.

During the months of August and September an unremitting search was made for the larvæ in the fæces of various animals and also in farmyard manure, but none were discoverable; but on September 21st the insect was found in all stages in a heap of heated grass mowings, the temperature of which varied from 70° to 98° F. The larvæ occurred in the cooler portions as well as in the older and quite cold deposits, but the eggs were laid in those areas which gave the highest temperatures. The winter is passed in both the larval and pupal stages.

SUMMARY OF LIFE-CYCLE.
Larvæ fed on moist sheeps' dung.

Average day temperature	72° F.
Average night temperature	65° F.
Month	August.
Ova—Incubation period	2–3 days.
Larval stage	14–21 ,,
Pupal stage	9–13 ,,
Complete cycle	25–37 ,,

Food allowed to partly dry and some light admitted.
Temperatures as above during month of August.

Ova—Incubation period	2–3 days.
Larval stage	31–78 ,,
Pupal stage approximately as above.	
Complete cycle	42–78 ,,

Several larvæ of this brood did not pupate before winter.

Preventive Inoculations against Enteric Fever (Les Inoculations Preventives Contre La Fièvre Typhoide).—By Arnold Netter. *Bulletin de l'Institut Pasteur*, vol iv., 1906. This is a series of articles which commence with an historical review, the author citing examples of decrease in typhoid in civilised countries, *i.e* :—

In England, enteric mortality was 43 per 1,000,000, 1871-80; 22 per 1,000,000, 1881-90.

In Vienna, enteric mortality was 12·4 per 1,000, 1866-73; 0·8 per 1,000, 1890-94.

In Munich, enteric mortality was 22·0 per 1,000, 1851-59; 0·9 per 1,000, 1890-94.

In German Army, enteric mortality was 0·6 per 1,000, 1881-86; 0·1 per 1,000, 1901-02.

In German Army, enteric admission-rate was 8·4 per 1,000, 1881-86; 0·9 per 1,000, 1901-02.

These results are stated to be due to improved sanitary conditions, but enteric fever is not likely to be eradicated except in a far distant future;

and even if eradicated in civilised countries will continue as a danger in others. The history of campaigns shows how the presence of enteric fever in any locality endemically lights up epidemics in armies.

In 1870 the German field troops had 73,396 cases and 8,789 deaths.

In the Tunis campaigns the French had 4,200 cases in an average strength of 20,000; an admission-rate of 250 per 1,000, and mortality of 50·1 per 1,000, between August 21st and end of the year 1881.

In Algeria the French troops in peace had an enteric death-rate of 4·14 per 1,000 (1872-1888).

In Tunis the French (excluding war years) had a mortality of 7·4 per 1,000, as compared with 2·62 for the home army (1872 to 1888).

In Great Britain, in 1898, the admission- and death-rates for enteric in the troops were 1·2 and 0·24 per 1,000; in Gibraltar, 4·2 and 1·32; Egypt, 81 and 23·4; South Africa, 32·9 and 5·77; India, 36 and 10 (Peshawar, 95·4 and 31, Quetta 108 and 35).

These facts furnish a reason why some immunising method should be employed, and A. E. Wright, says the author, has given it to us. It has been proved useful in the British Army, the German Government after a severe test has sanctioned it in connection with the Herrero campaign, and Sclavo has used it in Tuscany amongst families where enteric was rife.

In an historical review of the early efforts at immunisation, the claims of Pfeiffer and Kolle, and of Haffkine, are noted, along with those of Wright, as regards priority. But the succeeding attempts to introduce inoculation are allowed to be entirely British. In other countries antityphoid vaccinations were confined to laboratory experiments (Levy in Austria, Pfeiffer and Marx, Shiga, Brieger and Mayer, Bassenge and Rimpau, and Wassermann in Germany, Besredka in France, and Dziergowsky in Russia). A German Government commission, composed of Koch, Gaffky, Kirchner, Donitz and Kolle, studied the question in connection with the South-west African expedition, and more than 4,000 soldiers were inoculated.

A section of the articles next deals with the preparation of the vaccine material and the local and general symptoms following inoculation. It gives in detail the methods of Wright, Martin and Leishman, Lamb and Forster, Pfeiffer and Kolle, and Wassermann.

Next follows a section dealing with the new properties of the blood after antityphoid inoculation. It draws attention to the importance of the negative phase, and to the necessity of practising inoculation as much as possible in non-endemic areas.

Statistics are then given showing the value of inoculations. They include the various English statistics, namely, Wright's various South African statistics, the Maidstone statistics, Cullinan's Richmond Asylum statistics, Crombie's, Ward's statistics of the 7th Hussars, and what the author says are official unpublished statistics of the 17th Lancers at Meerut received from Leishman. He also gives Morgenroth's German South-west African statistics. The indications for inoculations are summed up as follows:—

(1) People about to stay in localities where enteric is endemic, and who are ignorant of the precautions that ought to be taken to diminish risk, should be inoculated.

(2) The inoculations should be completed before embarkation for such localities. It is inconvenient to give the second inoculation on board ship, and many on the German transports refused to be vaccinated a second time on board.

(3) Inoculations must continue to be voluntary.
(4) The *personnel* of medical units, especially, should be inoculated.
(5) At present it is not advisable to recommend inoculation of members of a family where enteric has broken out, and where one can practise isolation of the patient and disinfection of all discharges, &c.
(6) Workers in scientific laboratories and civil hospitals are a class, especially, who should be inoculated.

The last section of the series of articles gives an account of the various new methods of preparing the vaccines, along with a comparison of these methods, in which the report of the German committee of investigation is quoted. The author states that Wright's method is the most easy of application for preparation of vaccines in large quantities, and that it also appears to give the best results. But he finally advocates Besredka's method of combining the vaccines with antityphoid serum as being the most rapid and effective method of conferring immunity, in that it immunises in twenty-four hours, provokes no local or general reaction, does not set up any other action (*i.e.*, a negative phase), and maintains immunity for a longer period than any other method.

W. G. M.

Correspondence.

GUN DEAFNESS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I do not propose to discuss the causes or the frequency of gun deafness, but to enquire from correspondents what are considered the best practical means of prevention in peace and war, and whether they can be enforced. At Shoeburyness, where there is much heavy gun practice and experimental gunnery work, decided deafness is not common and perforation of the membrana tympani is rare. It is, I think, the opinion of most instructors that constant gun practice impairs their hearing.

The precautions usually recommended, and usually adopted at gun practice here, are (1) to keep the mouth slightly open, and stand facing the same way as the gun, and, if possible, not in front of the line of the breech; (2) to keep a loose wad of wool or an ear protector in each meatus.

A loose wad of wool or waste is as much used as anything, and, though not very cleanly, is generally available. Some men say their ears "catch cold" when the wool is taken out, and others that a little wool sometimes lodges and irritates the ear, and has to be syringed out. Wool is said not to afford sufficient protection in the Navy during heavy gun practice on board ship.

Mallock's ear protector is rather difficult to retain and to keep clean;

Elliott's, being perforated, permits the ordinary tones of the voice to be heard, it can be cleaned, and is the best apparatus that I have seen.

I am, &c.,

Shoeburyness, *March 11th*, 1907.

H. J. FLETCHER, *Lieutenant-Colonel, R.A.M.C.*

RESPIRATION AND DISEASE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The perusal of Major Fowler's most interesting article on "Auto-Intoxication and Liver Inadequacy," which appeared in last month's issue of our Journal, has led me to write these few lines on a subject of no less importance. The absurd manner in which the majority of soldiers carry out their respiratory functions is, I am sure, an important agent in the production of many of their ailments.

It is clear that if the respiratory act is performed in a faulty manner, not only is respiratory exchange imperfectly carried out, but the abnormal air pressure to which the pulmonary cells are thereby subjected finally brings about their destruction. In normal respiration the thorax is expanded and contracted solely by the action of the muscles situated below the level of the clavicles. This mechanism ensures the adequate potency of the airway and the noiseless flow of air to and from the lungs, and under the circumstances the intrapulmonary air pressure is never less than that of the surrounding atmosphere, and never greater than that found in the correct production of speech and song. Critical observation will reveal the fact that these conditions, of such vital importance to the health of the pulmonary cells, are not present in the ordinary recruit, for, during even the most moderate form of exercise, during conversation, or when trying to take a deep breath, he sucks in the air by raising the shoulders and contracting the muscles of the neck, in other words, a more or less extraordinary effort, suggesting respiratory failure, has been made. The inevitable "sniff" or "gasp" which accompanies this act, plainly shows that the airway has been narrowed; the consequence of this is, of course, to temporarily lower the air pressure in the respiratory tract and produce a transient flushing of the vessels. Each expiration is also noticeable as an audible act, due to the partial closure of the glottis reflexly, brought about by the strain placed upon the muscles of the neck in holding up the thorax; this, combined with the fact that the upper chest sinks in at a greater rate than the lower, owing to the inability of the cervical and other muscles to nicely regulate expiration, brings about a harmful increase of intrapulmonary pressure. That these two factors sooner or later impair the vitality of the lung tissues is certain, and the onset of pulmonary and other affections becomes merely a question of time.

It can be readily understood when this harmful type of respiration remains uncorrected, loss of mobility in the comparatively little used

parts of the thoracic cage must increase year by year, and when it is borne in mind that the greater number of recruits are departures from the physiological type of the human animal, to allow such beings to indulge in physical exercises of even the most elementary sort, before giving them instruction in the most advantageous methods of breathing during exercise and at other times, is to hasten the onset of that premature senility with which they are already threatened.

It may be of interest to note that this more or less shallow, audible, jerky and uncontrolled method of breathing is known to teachers as the clavicular or superior costal mechanism. Varying as it does in degree it is, of course, always found combined with a greater or lesser amount of the so-called lower costal or abdominal types, the two latter sometimes known as *the high fixed chest methods of breathing*, being very rightly recognised by them as the only correct ways of working the bellows.

In conclusion, I would add that by a properly directed form of diaphragmatic drill, a wonderful degree of restoration towards physiological conditions can be brought about even after early adult life. Not only can the "wind" be vastly improved thereby, but also the general health, for it should ever be remembered that the proper use of the thorax ensures the well-being of the lungs and is of great assistance to the adequate performance of the duties of the heart and other organs, the mechanical kneading to which the abdominal viscera are subjected being particularly beneficial in promoting hepatic and intestinal activity. In short, that great factor in disease, auto-intoxication, could hardly exist were a correct method of breathing to become more general.

I am, &c.,

Chatham, R. F. E. Austin,
March 12th, 1907. *Major*, *R.A.M.C.*

THE "ALLIES" OF ENTERIC FEVER IN INDIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—Lieutenant-Colonel C. H. Melville, in his rejoinder to the above article by Lieutenant-Colonel S. Glenn Allen, R.A.M.C., in the February number of the Journal, relative to the "Thornhill system of trenching," has made the following statement: "I admit that there are Stations in India, Quetta, for instance, where the Thornhill system is difficult to carry out, if not impracticable, owing to difficulties with regard to procuring suitable soil. In such places biological installations should be set up. Quetta is the most ghastly commentary on the 'deep burial' system that one could wish to see. It was instituted there on the recommendation of a committee, of which I was a member, in 1898, as a *temporary expedient*. It has been continued as a permanent system, and I think one visit to the Sahibzada pits would be sufficient to convict any believer in deep burial of the error of his ways." As this assertion would lead your readers to believe that no effort had since been made to introduce a

better and more scientific method for the removal and disposal of night soil from cantonments than the deep pit (not burial) system, will you kindly grant me space to remark that more than four years ago, when I was Senior Medical Officer and Sanitary Officer at Quetta, a very complete scheme was drawn up by Colonel, now Brigadier-General, Sir J. R. Macdonald, K.C.I.E., C.B., and myself. The scheme provided for the water-carriage removal of sewage from cantonments to a site some three miles away. As this district was suitable for the purposes of cultivation, it was part of the scheme to erect there a biological installation. The crops treated by the effluent would have been a fruitful source of revenue to the cantonment funds. I grant you the initial cost would have been large, and probably on that account no further action has been taken.

I am, &c.,
J. BATTERSBY,
Lieutenant-Colonel, R.A.M.C.

Yacht Club, Bombay,
March 9th, 1907.

INDIAN INVALIDING.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to my article on "Indian Invaliding" in the February number, it is satisfactory to note that some of the suggestions detailed therein are now in force, and with the happiest results. For example: The time of assembly of Boards has been altered, the Rest Camp horror no longer exists, and neither at Colaba nor Deolalie has there been anything approaching to strain during the present trooping season. Indeed, in the latter, we have been able to reduce the number of beds from about 340 to 160—much to the disgust of the Senior Medical Officer, I fear; but, to his credit be it said, with his loyal co-operation—and in neither have tents been required, except for purposes of isolation. What a contrast to former years. All this must, of necessity, mean considerable saving, but will that saving be apportioned to remedy some of the other defects, in whole or in part? "I hae ma doots"; for that somewhat nebulous individuality which we term "Government" is nearly akin, in many ways, to the daughter of the horse-leech: it will always *take* with an impartial and cheerful rapacity, but when it is a question of *give*—well! "that's another story." However, we have made a beginning and there is encouragement in that fact.

I might just add, if you will permit me, that, with regard to the same article, your compositor possesses a goodly proportion of the leaven of Bret Harte's "Heathen Chinee," particularly with respect to punctuation. I plead guilty to my full share of original sin, but I emphatically demur when, *inter alia*, I am presented to "kind readers" as a sort of semicolon drunkard.

Yours faithfully,
R. H. FORMAN,
Colonel, R.A.M.C.

20, *Queen's Road, Bombay,*
March 6th, 1907.

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Original Communications.

THE PROGRESS OF ANTI-TYPHOID INOCULATION IN THE ARMY.

By BREVET-LIEUTENANT-COLONEL W. B. LEISHMAN.
Royal Army Medical Corps.

THE system of protective inoculation against enteric fever, which was introduced by Sir A. E. Wright in 1897, has recently been resumed in the Army as a voluntary measure, and every effort is being made to secure the inoculation of as many men as possible, prior to their embarkation for countries in which the disease is endemic. Under these circumstances, I feel that an apology is hardly necessary for the following account of what has been and is being done with regard to typhoid vaccine.

I may, in the first place, recall the chief points in the history of inoculation. After it had been employed, on a large scale, upon the troops in India and Egypt, with results which appeared most encouraging, the system was adopted in the case of the troops leaving this country for the Boer War. Although perfectly voluntary as regards the men, a very large proportion availed themselves of the method, and it was hoped that, at the conclusion of the war, the question of the amount of protection afforded by inoculation would be definitely settled, one way or the other. Unfortunately, for reasons that must occur to all, statistical evidence on the subject was extremely hard to collect, and was only available with regard to certain units, in which it had been possible to ascertain the inci-

dence of enteric among the inoculated and the uninoculated. I need not enter into an analysis of such statistical records as were made and published, but will only mention that it was obvious that a considerable diversity of opinion existed as to the merits or demerits of inoculation.

This divergence of opinion was one of the reasons which led to the temporary abandonment of the system after the conclusion of the war. The other was concerned with the possible dangers of a "negative phase," *i.e.*, a period following on inoculation, during which the natural powers of resistance to infection are reduced below their normal level. Sir A. E. Wright, with his customary candour, had been the first to point out the possible existence of such a negative phase and the dangers to which it might expose the inoculated before it had given place to the "positive phase," with its accompanying increase of resistance to infection.

The system was accordingly discontinued until such time as these differences of opinion and doubts could be reconciled and cleared up, and to this end a Committee was appointed by the Army Council to collect and consider all the evidence which was available, and to carry out any investigations which they thought proper. This Committee, of which I have the honour to be a member, under the chairmanship of Dr. C. J. Martin, F.R.S., Director of the Lister Institute, is still in existence, and it was upon its recommendation that typhoid inoculation was resumed, after an interregnum of a year and a half. Research work, on lines approved by the Committee, has also been carried out continuously at the Royal Army Medical College, with the object of improving the system.

The first portion of this work was published in the Corps Journal of July, 1905, and in the *Journal of Hygiene* of that year. Since then I have had the advantage of the constant collaboration of Major W. S. Harrison, while, more recently, Major H. W. Grattan and Lieutenant R. G. Archibald have been attached to the Pathological Laboratory to expedite the progress of the investigation.

The article alluded to above embodied the results of a series of quantitative tests of the substances which appear in the blood after inoculation, these tests being carried out daily, for a period of four weeks, on groups of inoculated men of the 2nd Royal Fusiliers. The dosage of vaccine was different for each group, and one of the results of our work was the determination of the dose of vaccine which promised to produce the greatest quantity of what are

termed "protective substances," without undue severity of the local or general reaction, and without danger of inducing a negative phase of resistance. The dose thus fixed we have adhered to in the case of the vaccine since prepared at and issued from the Royal Army Medical College.

The employment of two inoculations and the ten days' interval between first and second inoculation were also indicated by the results of this analytical work and are also adhered to at the present moment.

While the Committee were convinced, from a careful study of the whole of the available statistics, that inoculation had a distinctly favourable influence, both on the incidence and on the case mortality of enteric, it was recognised that the results were not uniform, and that, in some instances, little or no protection appeared to have been conferred by the inoculations. They recommended, accordingly, that further research work should be undertaken with the objects of improving the vaccine, if that were possible, and of securing a greater degree of uniformity in the amount of protection conferred by the process. This work was entrusted to Major Harrison and myself, and some of the more interesting results of the investigation are embodied in the Report which follows this article.

Another recommendation of the Committee which has been carried into effect, lay in the attachment of a medical officer to each regiment proceeding on foreign service, after a special course of instruction at the Royal Army Medical College. These officers are to remain with their regiments for three years, and collect and report upon all the information obtainable as to the protection conferred upon the inoculated men in the regiment. At the present moment eight medical officers are so employed, and it is hoped that, in this manner, we shall soon be in possession of definite information as to the effects of inoculation, checked by agglutination tests, *post-mortem* evidence, &c., such as were unobtainable under conditions of active service.

One of these regiments, the 17th Lancers, suffered from a severe epidemic of enteric shortly after its arrival at Meerut in 1905, and the report of the attached medical officer, Lieutenant Luxmoore, furnishes a striking piece of evidence as to the protective effect of the inoculations. It may be pointed out that this epidemic affords as good a test case as could be desired, and that it has all the value of a laboratory experiment, being checked by blood examinations and *post-mortem* examinations, whenever these were possible. The uninoculated portion of the regiment served, unintentionally,

as "controls," and the fact that of 63 cases, 61 occurred among these controls, and only two among the inoculated men of the regiment, is one the significance of which it is hard to minimise. Further, it will be noticed by those who study the report, that both of the inoculated men who contracted enteric were of those who refused the second inoculation, and who thus, in our opinion, had not received the full measure of protection following upon re-inoculation. The results of inoculation in this regiment have another interest, inasmuch as they are the first that have come to hand from a unit in which the vaccine employed was prepared and standardised with the modifications suggested by some of the results of our experimental investigations. These modifications will be referred to again.

While it is desirable, on many grounds, that men should be inoculated at home, prior to embarkation, this cannot always be done, and at times the numbers who come forward, in response to the lecture which is given on the subject, are so small as to suggest that the lecturer has not himself been convinced as to the benefits of inoculation. As a result, the proportion of inoculated men in many corps serving in India and other foreign stations is very low, and efforts are now being made to secure a more liberal response to the carrying out of further inoculations on the spot. In India, in particular, these efforts are being put forth, and 15,000 doses of vaccine have been despatched from the Royal Army Medical College on the requisition of the Principal Medical Officer in India. The cause of inoculation in India has been greatly strengthened by the keen personal interest shown by the Commander-in-Chief, Lord Kitchener, who has been in communication with the Anti-typhoid Committee on the subject, and who has himself suggested lines along which efforts should be made for the improvement of the system. Among other measures adopted to further the carrying out of inoculations in India, may be mentioned the appointment of a senior officer to each of the commands to supervise the inoculations and to deliver lectures to the men when necessary. In addition, a specially designed case, containing all the apparatus necessary for inoculation, has been issued to every command.

In many instances, owing to the exigencies of furlough, short notice, &c., it has only been found possible to carry out the first inoculations before embarkation; in these circumstances the second has to be done on board the transport, and for this purpose vaccine and syringes are placed on board each ship by the embarking medical officer at Southampton. It was felt that, although this

procedure entailed obvious disadvantages, we should not be justified in refusing to sanction such a compromise under existing conditions.

Preparation of the Vaccine.—A short account of the manner in which the vaccine is now prepared may be given. The method, in its essentials, is that of Sir A. E. Wright, which we have modified in a few particulars in the light of the research work on which we have been continuously engaged during the last two years. We still employ a non-virulent strain of typhoid for our vaccine, although the relative value of virulent and non-virulent cultures cannot be said to be definitely settled, and some of our recent work would appear in favour of the employment of a virulent culture. The good results, however, which have been recently obtained with a vaccine prepared from a non-virulent strain, would at all events indicate that virulence is not essential to the protecting properties of a vaccine, and strong evidence is required before such a change of procedure would appear to us to be justified.

The typhoid germs are grown in broth, of a definite reaction, and incubated at 37° C. for from twenty-four to forty-eight hours, never longer. In order to encourage free growth special flasks are used, giving a shallow layer of about an inch of medium, so as to permit of good aeration, this being essential to obtain maximum development. At the end of this period the contents of a series of flasks are mixed together in a 2-litre flask and sterilised by heat.

The temperature at which the vaccine is killed is one of the points which has been modified as a result of our experimental work. Formerly, a temperature of 60° to 65° C. was employed for this purpose, but stress was not then laid upon accuracy in this respect, and, at times, this limit was exceeded. The measurement of the temperature used to be controlled by the ingenious paraffin thermometer devised by Sir A. E. Wright, but, in actual practice, this was not always to be relied upon, and the temperature occasionally rose considerably above 65° C. Some of our experiments, as will be seen from Major Harrison's report, disclosed the fact that such super-heated vaccines had lost a large part, if not all, of their power of inducing the appearance of protective substances in the blood of inoculated rabbits, in other words, their efficacy as vaccines had either been greatly diminished or destroyed by the excessive temperature to which the typhoid germs had been exposed. In view of the great importance of this fact a series of experiments was carried out in order to determine the lowest point at which sterility could be assured after heating for one hour. The

point proved to be a very definite one, 53° C., and to this point we have adhered up to the present moment. The heating is carried out in a water-bath, specially constructed for the purpose, and fitted with a thermo-regulator, by which the temperature can be controlled with perfect accuracy. The large flask in which the vaccine is sterilised has no angles or side tubes, and the broth cultures are introduced in such a manner that there is no splashing of the culture on the neck of the flask above the level at which the fluid stands. It is necessary to observe these precautions in order to be certain of securing sterility with the low temperature employed. Samples are then taken for the purpose of proving the fact of sterility by aerobic and anaerobic cultures. A small percentage of lysol is afterwards added in order to prevent the danger of subsequent contamination of the vaccine during the processes of opening and closing the phials used to hold the vaccine. The amount of lysol used is ·25 per cent., this quantity having been determined by experiment and found to be sufficient to sterilise a vaccine artificially contaminated with microbes of many kinds, including anaerobes and spore-bearing organisms, within five days.

Standardisation.—Numerous experiments have been carried out with a view to effecting an improvement in the means at present at our disposal for estimating the strength of a bacterial vaccine, but, so far, without great success; for the present we rely upon an enumeration of the number of bacteria by means of Wright's blood counting method.[1] In this method a volume of the vaccine is mixed with a similar volume of a known dilution of blood, the relative numbers of bacteria and red cells being determined by counting a series of microscopic fields of a stained film, the strength of the vaccine being then ascertained by a simple calculation. This method, an excellent one for germs which are not influenced by the blood fluids, has not, in our hands, proved sufficiently accurate in dealing with typhoid germs, since we have found that a certain proportion of these are dissolved up by the action of blood fluids, and in this way the strength of the vaccine is liable to be underestimated. The modification of this method described by Major Harrison,[2] in which the blood fluids are replaced by an inert fluid, by which the bacteria are not affected, gives much more regular results, and is the method which we at present employ in the standardisation of the vaccine.

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[1] *Lancet*, July 5th, 1902.

[2] JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, March, 1905.

Numerous other methods have been tried, such as the one advocated by Lamb and Forster, but none have proved capable of detecting such small differences in the strength of the vaccine as that just mentioned. At the same time we are forced to recognise that the present system of enumerating the germs, although sufficiently accurate for this purpose, does not necessarily afford us an accurate measurement of the protective properties of a vaccine. We are still in doubt as to which of the protective substances, whose appearance can be demonstrated in the blood after inoculation, is the one to which the immunity is mostly due, and until this most important point is settled, no method of standardisation can be regarded as completely satisfactory. We are now engaged in making a comparison between the blood picture following inoculation and that which results from an actual attack of enteric fever, which, we trust, will throw further light upon the subject.

After proof of sterility and standardisation, the vaccine is distributed into sterilised glass phials and capsules of varying capacity, and is then ready for use. Full instructions are, of course, sent out with each bottle of vaccine.

A not inconsiderable objection to the process of inoculation in the past has been the pain and swelling at the seat of inoculation, called the "local reaction." It may, in the future, be possible to avoid this altogether, but, at the present moment, a certain amount of this local reaction appears to be unavoidable; it is present in the case of nearly all other bacterial vaccines, in greater or less degree, and, in the numerous typhoid vaccines which have been used in Germany or France, the reaction, in most instances, is certainly no less than with Sir A. E. Wright's method. We have made numerous experiments with a view to the diminution of the reaction, and although without much success, it may at least be said that, with our present system of dosage, we never meet with the very severe reactions of earlier days. As the reaction is sensibly milder, there is no longer the same reason for inoculating in the flank, and we now advise the outer side of the upper arm, or the pectoral region, as the best site for the injection; the pain and swelling being no longer excessive, either of these situations offers obvious advantages over the flank, not the least of these being that the individual has no pain or stiffness on walking, and is thus less likely to act as a discouraging example to his uninoculated comrade.

The importance of carrying out the second inoculation should always be borne in mind; not only is the reaction less severe than when the two doses are given together, but it has been clearly

shown by animal experiments that a higher degree of immunity is produced by successive doses of vaccine than by a single one. In this connection the incidence of enteric in the case of the 17th Lancers may be recalled; here the only cases of enteric which occurred among the inoculated were in men who had refused to have a second inoculation. This fact does not stand alone, and there are many other instances showing that re-inoculation affords a higher degree of immunity than a single dose. The same thing is brought out by the results which have been published by the German authorities in connection with the anti-typhoid inoculations of the troops which were engaged in the Herero campaign; in this case the increased degree of protection afforded by two, or still more by three, inoculations, is clearly brought out by the careful analysis of the statistical results which have recently been published. In the lectures which are given to the men before calling for volunteers for inoculation, this point should always be emphasised, and it should be impressed upon them that a single dose will not give them the maximum degree of protection which may be expected from the system.

We have seen no reason to depart from the practice of allowing ten days to elapse between the two inoculations; a closer approximation of the doses is undesirable on several grounds, and Continental experience is in accord with our own in regarding the ninth or tenth day as being the most suitable for re-inoculation. There is not the same objection to allowing a longer interval than ten days between the two doses, and at times it will be found necessary to sanction such an extension, but, if possible, the optimum interval of ten days should be as closely adhered to as may be.

Dosage.—The quantity of vaccine to be given for first and second inoculations respectively, remains for the present at the amount which appeared to us, from the Aldershot work, to produce the maximum quantity of protective substances with the minimum severity of reaction, viz., 500 million bacteria for first inoculation, and 1,000 million for second inoculation; these amounts are, as a rule, contained in ½ and 1 c.c., respectively, of the vaccine. At times, however, owing to a greater or lesser concentration of the vaccine, the volume of the dose may be less or more than the above; such differences in the amount of vaccine to be given are always marked on the bottles, and it will be understood that, although the dose appears to vary with different samples of vaccine, the difference is only apparent, and the same number of bacteria are given in each instance.

The details of the experimental work, to which reference has been made, are appended in the form of a report by Major Harrison, and will be followed shortly by a second, bringing the results up to date. These reports, which are published at the instance of the Anti-Typhoid Committee, will embody the more important of our results. The special report of Lieutenant Luxmoore on the results of the inoculation of the 17th Lancers is also given, and may serve as a useful object lesson to illustrate the lectures of those who may have to bring the advantages of inoculation to the notice of the soldiers.

In conclusion, it may be mentioned that any who may wish to get a more general view of the subject of anti-typhoid inoculations will find an excellent survey of the whole question in the *Bulletin de l'Institut Pasteur*, vol. iv., 1906, by Professor Netter. In this review a full description and analysis is given of the numerous methods which, at one time or another, have been proposed for active immunisation against enteric fever. In the case of those methods which have got beyond the laboratory stage, comparatively few in number, the results are also given, both of the blood changes following inoculation and of the statistical evidence as to the protection afforded by the process. In summing up, at the conclusion of his article, Professor Netter, in speaking of the system which is the subject of the present communication, says, "It may with confidence be recommended in every case in which it appears necessary to have resort to anti-typhoid inoculations."

REPORT ON THE RESULTS OF EXPERIMENTS IN CONNECTION WITH ANTI-TYPHOID VACCINE.

By Major W. S. HARRISON.
Royal Army Medical Corps.

Experiments on Various Methods of Killing the Cultures.

Desiccation.—Emulsions of *Bacillus typhosus*, of three different strains, were made in sterile distilled water and placed in a vacuum exsiccator over sulphuric acid at 37° C. with the following results :—

First Experiment.—Emulsions sterile in twenty-four hours.

Second Experiment.—Emulsions sterile in seventy-two hours.

These experiments were made with small quantities of emulsion in watch glasses; when, however, larger quantities of emulsion were used complete sterilisation was not obtained, and it was found that a limit was placed to the length of time during which the specimens could be exposed in the exsiccator by the fact that, after six days, the resulting substance formed a tough membranous material which it was impossible to emulsify; this change took place quite quickly between the fifth and sixth days.

Third Experiment.—Five cc. of an emulsion of *B. typhosus* in water were placed in each of three watch glasses and one lot of 2 cc. was placed in a fourth glass. The samples were placed in the exsiccator with the result that the glass which had contained 2 cc. of emulsion was sterile at the end of two days, while the glasses which had contained 5 cc. were not sterile at the end of six days, by which time it was impossible to emulsify them, though, at the end of five days, they had emulsified quite readily. This phenomenon has occurred every time an emulsion has been dried for more than five days.

Fourth and Fifth Experiments.—A very thick emulsion of *B. typhosus* in 1 cc. of water gave a few isolated colonies only, when planted on to agar, at the end of four days' desiccation.

It was thought that probably the bacteria which survived owed their escape to being buried in the depths of the scales formed by drying the emulsion, where they would escape complete desiccation. Several attempts were made to overcome the difficulty by increasing the area over which the emulsion was spread and by aerating the emulsion before placing it in the exsiccator, so that when the

vacuum was produced the escaping air blew the emulsion into a fine froth; these expedients were, however, only partially successful, and it was considered that this method of desiccation could not be relied on to produce a sterile vaccine, except by way of filtering the emulsions of desiccated bacteria after autolysis had occurred. It was found that the desiccated bacteria, so long as they had not been dried for more than five days, broke up on the addition of normal saline solution into an emulsion which frothed easily and which, at the end of three days in the incubator at 37° C., was found, on microscopic examination, to have become almost completely autolysed, only an occasional unaltered rod being visible in stained specimens, which consisted of masses of granular *débris*. On filtering the autolysed emulsion an opalescent, slightly yellow fluid was obtained, which gave a flocculent precipitate with alcohol on heating to boiling point and on the addition of solutions of salts of the heavy metals, but no precipitate on the addition of nitric acid. It is proposed to take up the further study of the products of the autolysis of desiccated typhoid bacilli along with that of the products of autolysis got in other ways.

Chloroform.—Emulsions of the bacteria in normal saline, or cultures in broth, were put into an apparatus connected with a water pump, and so arranged that a stream of air was drawn first through a bottle containing chloroform and then through the culture or emulsion. At the end of the experiment the chloroform bottle was disconnected and air only was drawn through the culture for an hour, so as to free it from chloroform. A number of experiments of this kind were done, and it was found, in all cases, that an exposure for one hour to the chloroform-saturated air was sufficient to kill the bacteria. It was noticed that emulsions killed in this way frothed easily on shaking just as did emulsions of desiccated bacteria, and examination of stained specimens showed that autolysis occurred, but that it did not take place so rapidly as in emulsions of desiccated bacteria; as a rule, exposure of the chloroformed cultures for ten days at 37° C. was necessary before autolysis was complete; at the end of that time practically all recognisable bacteria were absent from stained specimens, which showed just a mass of formless, ill-staining granules.

Heat.—The emulsions or cultures, as the case might be, were sealed up in glass capsules and completely immersed in a water-bath at the required temperature. The following were the results:—

50° to 51° C. for 72 hours = not sterile.
52° C. for 1 hour = diffuse growth when planted on agar.
52° C. for 2½ hours = gave growth of isolated colonies on agar.
52° C. for 3 hours = gave a single colony on agar.
52° C. for 24 hours = sterile.
53° C. for ½ hour = not sterile.
53° C. for 1 hour = sterile.
55° C. for ½ hour = sterile.

From these results it appeared that, for an exposure of one hour, 53° C. is the minimum temperature at which one can ensure sterility of a culture of *B. typhosus*. The experiment has been repeated many times and with three different strains of the bacterium; the result has been the same in all cases. It was found, however, when working with larger quantities of material, 2 litres and upwards, that it was necessary to take very special precautions to ensure that the heat reached every portion of the fluid, otherwise a few stragglers survived. It was also found necessary to check the readings of one's laboratory thermometers by means of a standard instrument, since most of those in general use will be found to give an error of a degree, or even more, at some portion of the scale.

Autolysis was found to occur in cultures killed by an exposure to 53° C. for one hour, but it did not occur nearly so rapidly, nor was it as complete, as in the case of either the chloroformed cultures or of emulsions of desiccated bacteria. Several observations were made, *apropos* of this point, in cultures heated to 55° C. and 60° C., and it was found that in these cases there was practically no autolysis recognisable under the microscope, whereas in cultures killed by heating to 52° C. for twenty-four hours marked autolysis was noticed after two days' incubation at 37° C.

Alcohol.—Varying proportions of absolute alcohol were added to a broth culture of *B. typhosus*. In the first experiment it was found that 10 per cent. alcohol just failed to kill all the bacteria in two days at 37° C., while 20 per cent. alcohol produced complete sterility in this time. In a second experiment, using an emulsion of the micro-organisms in saline, 10 per cent. alcohol produced sterility in twenty-four hours, so that the proportion of alcohol necessary to kill *B. typhosus* in twenty-four hours seems to be somewhere about 10 per cent. Examination of emulsions killed by this quantity of alcohol in twenty-four hours, gave evidence of no trace of autolysis having occurred after seven days' incubation of the killed cultures at 37° C.

Toluol.—The use of this substance was suggested by the fact

that it is largely employed for the preservation of anti-sera and toxins from contamination, and in experiments on the autolysis of animal tissues. In the first experiment a layer of toluol, about ¼ inch deep, was run on to the surface of a twenty-four hour broth culture of *B. typhosus* in a tube, the tube was capped with rubber and placed in the incubator at 37° C.; after twenty-four hours' exposure a culture on agar gave a single colony, and on the third day the culture was found to be sterile. The rubber cap was then removed and the toluol allowed to evaporate, which it did completely at the end of two days. On the fifth day after the addition of toluol marked autolysis was found to have occurred in the culture, very few unaltered rods being present; many of the bacteria were spherulated, and the majority of those forms which could be recognised as the remains of bacteria just showed the "ghosts" of outlines of rods or spheres.

In a second experiment, with an emulsion of *B. typhosus* in saline, sterilisation was complete in twenty-four hours and autolysis practically complete at the end of seven days. From these and other experiments it would appear that one can rely on toluol to kill a culture or emulsion of typhoid bacilli within three days.

Experiments with different strains of the bacterium show that autolysis occurs much more rapidly with some strains than with others, and that it is more rapid in emulsions made with distilled water than in the case of those made with saline solution; this last is, however, only a temporary advantage, for the ultimate result as regards autolysis appears to be practically the same whether distilled water or saline be used for the making of the emulsions.

Some experiments were made with a view to determining whether the addition of alkalies or acids in small quantity would further the process of autolysis; the results showed that a very small quantity of alkali, or the addition of sufficient acid to produce an acid reaction in the emulsions, completely inhibited autolysis. From this, as well as from the effects of heating beyond 53° C., it would appear that the process of autolysis is something of a chemical nature, probably depending on a ferment. The point is of interest, since several writers (Neisser and Shiga, Wasserman and others) describe the preparation of a filtrate vaccine by "autolysis" of a culture which has been heated to 60° C. for one hour; it would seem that the fluid which they obtain in this way is rather the result of simple diffusion of the contents of the dead bacilli into the surrounding fluid than of a true autolysis.

Filtrates of emulsions killed by toluol and afterwards submitted

to autolysis, gave similar reactions to those given by filtrates of autolysed desiccated bacteria. It was found that toluol kept in the ordinary way in bottles could not be relied on to be free from spore-

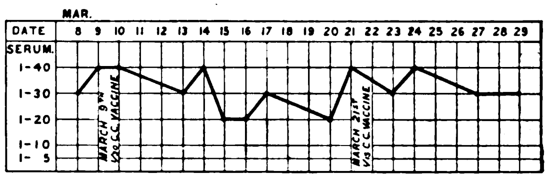


Chart I.—Bactericidal action of the serum of a rabbit which received $\frac{1}{30}$ cc. of a vaccine (killed at 65° C.) on March 9, and $\frac{1}{15}$ cc. of the same vaccine on March 21.

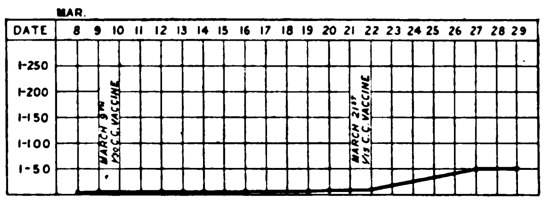


Chart II.—Agglutination value of the serum of a rabbit which received $\frac{1}{30}$ cc. of a vaccine (killed at 65° C.) on March 9, and $\frac{1}{15}$ cc. of the same vaccine on March 21.

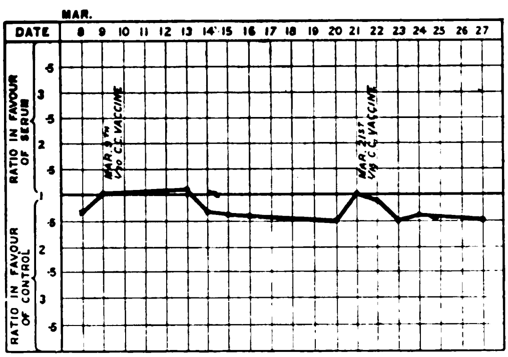


Chart III.—"Stimulin" action of the serum of a rabbit which received $\frac{1}{30}$ cc. of a vaccine (killed at 65° C.) on March 9, and $\frac{1}{15}$ cc. of the same vaccine on March 21.

bearing organisms, but it was easily sterilised by boiling for half an hour in sealed capsules, the test organism being *B. mesentericus*.

Glycerine.—Emulsions were made in varying strengths of glycerine and then placed in the incubator at 37° C., with the following results:—

100 per cent.	glycerine	=	sterile in	24 hours.
40 ,,	,,	=	,,	2 days.
20 ,,	,,	=	,,	4 ,,
10 ,,	,,	=	not sterile in	8 days.

Experiments on the Anti-tropic Substances Produced by Vaccines Prepared in Various Ways.

The technique employed for the measurement of these anti-tropic substances was the same as that employed at Aldershot during investigation into the blood changes consequent on anti-typhoid inoculation in man.[1]

First Experiment.—This was done in order to ascertain what effect overheating the culture would have on its value as a vaccine. An emulsion in saline of a twenty-four hour agar culture of *B. typhosus* (R), giving a count of 1,283 millions per cc., was heated to 65° C. for twenty minutes, and injected into a rabbit in doses of $\frac{1}{30}$ cc. and $\frac{1}{15}$ cc., with an interval between the doses of eleven days. The results of the experiment are shown in the accompanying charts (I. to III.). From these it will be seen that, after injection of a culture heated to 65° C., there was no rise in the bactericidal power of the rabbit's serum, very late and insignificant production of agglutinins and no evidence of the formation of stimulins. It would appear, then, that to overheat a culture of *B. typhosus* seriously impairs its vaccinating properties. These results agree with those of Friedberger and Moreschi,[2] who found that the higher the temperature at which a culture was killed the less its vaccinating properties.

Second Experiment.—The object of this experiment was to find out whether an emulsion of *B. typhosus* which had been killed by chloroform possessed any value as a vaccine. An emulsion of a twenty-four hour culture of typhoid bacilli was made in saline and killed by chloroform; a count of the emulsion showed 2313·95 million bacteria per cubic centimetre, or about twice as many as in the experiment quoted above. A rabbit was given $\frac{1}{60}$ cc. of the killed culture, and, eleven days later, another dose of $\frac{1}{30}$ cc. The results of the examination of the serum are to be seen in the accompanying charts (IV. to VI.). It will be seen that there was a rise in the bactericidal power of the rabbit's serum, and that the

[1] Leishman, Royal Army Medical Corps Journal, July, 1905.

[2] Friedberger and Moreschi, *Cent. für Bakt.*, xxxix., September 22nd, 1905, pp. 453-473.

chart follows very much the same lines as in vaccinated man. The same remarks apply also to the agglutinins, with the exception that they seem to have appeared rather earlier than they do in man.

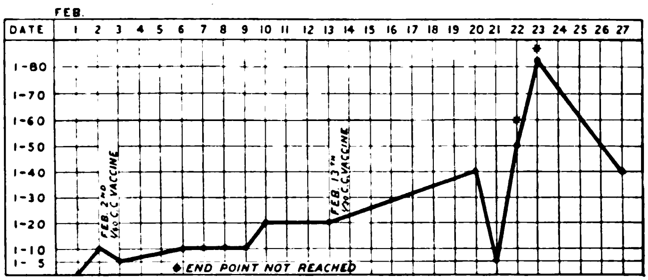


CHART IV.—Bactericidal action of the serum of a rabbit which received $\frac{1}{80}$ cc. of a vaccine (killed by chloroform) on February 2, and $\frac{1}{30}$ cc. of the same vaccine on February 13.

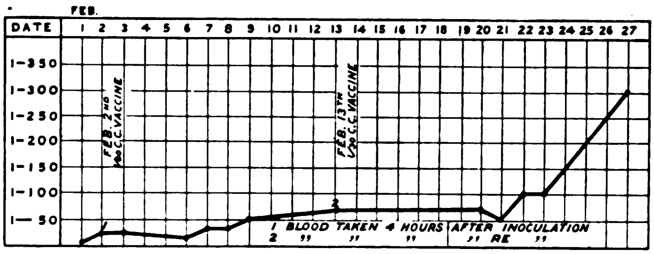


CHART V.—Agglutination value of the serum of a rabbit which received $\frac{1}{80}$ cc. of a vaccine (killed by chloroform) on February 2, and $\frac{1}{30}$ cc. of the same vaccine on February 13.

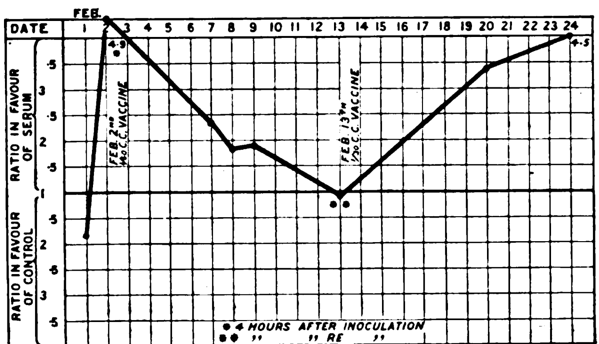


CHART VI.—"Stimulin" action of the serum of a rabbit which received $\frac{1}{80}$ cc. of a vaccine (killed by chloroform) on February 2, and $\frac{1}{30}$ cc. of the same vaccine on February 13.

With regard to "stimulins," there was a most remarkable and sudden appearance of a stimulin effect from serum taken only four hours after the first dose; this phenomenon was not repeated after

the second (and larger) dose, which was followed by a temporary drop in the stimulin value of the serum. It would appear from the results of subsequent experiments that the high stimulin value produced in this particular rabbit's serum was due to an individual peculiarity in the rabbit, for, though evidence of the formation of stimulins was found in the experiment next to be recorded, they never reached so high a level as in the present case.

Third Experiment.—This experiment was made for the purpose of making a comparative study of the anti-tropic substances produced by the injection into rabbits of vaccines of precisely the same strength but which had been killed in different ways. An emulsion of *B. typhosus* in saline, of a strength of 1,283 million bacteria per cubic centimetre, was made and divided into three portions; one portion was killed by heat at 60° C., one by heating to 53° C., and one by chloroform. Doses of $\frac{1}{30}$ cc. of vaccine were given to, in each case, three rabbits; fourteen days later doses of $\frac{1}{15}$ cc., and fourteen days later again doses of $\frac{1}{2}$ cc. were similarly given. The object of giving the large dose at the end was with a view to accentuating any differences there might be in the results of the inoculation of the different vaccines. The observations were made on the pooled sera of the rabbits of each group, so as to eliminate as far as possible the variations due to individual peculiarities in the animals. From the charts (VII. to IX.) it will be seen that the bactericidal curves followed approximately a parallel course in all cases, whereas in the case of agglutinins the rabbits vaccinated with the chloroformed culture gave a much feebler reaction. The stimulin curves show that, in this particular, the chloroformed vaccine had the advantage over the vaccine killed at 53° C., and that in the case of the vaccine killed by heating to 60° C., there was no stimulin effect produced from the doses of vaccine given.

An experiment was made to see if a comparison of the phagocytic index of the sera of the different groups gave any confirmation of the findings with regard to stimulins. The results were as follows:—

(1) Normal rabbit corpuscles, 3 vols. Heated normal rabbit serum, 3 vols. Emulsion of *B. typhosus*, 1 vol.	15″ at 37° C.	Average bacteria per phagocyte, 2·2.
(2) Normal rabbit corpuscles, 3 vols. Heated serum of vaccinated rabbits (60° C., vaccine), 3 vols. Emulsion of *B. typhosus*, 1 vol.	15″ at 37° C.	Average bacteria per phagocyte, 3·1.

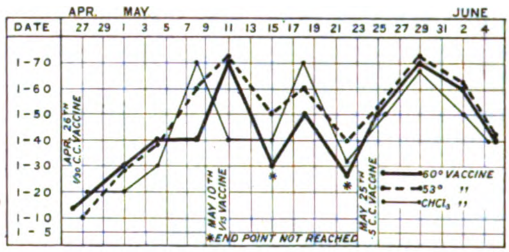


CHART VII.—Bactericidal action of sera of three groups of rabbits, which received doses of anti-typhoid vaccine, killed (1) at 60° C.; (2) at 53° C.; (3) by chloroform. First dose, $\frac{1}{30}$ cc. on April 26; 2nd dose, $\frac{1}{15}$ cc. on May 10; 3rd dose, $\frac{1}{2}$ cc. on May 25.

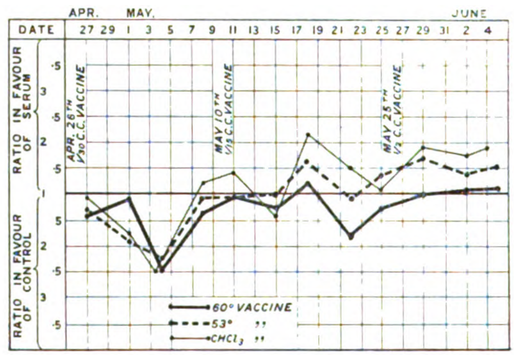


CHART VIII.—"Stimulin" action of the sera of three groups of rabbits, which received doses of anti-typhoid vaccine, killed (1) at 60° C.; (2) at 53° C.; (3) by chloroform. First dose, $\frac{1}{30}$ cc. on April 26; 2nd dose, $\frac{1}{15}$ cc. on May 10; 3rd dose, $\frac{1}{2}$ cc. on May 25.

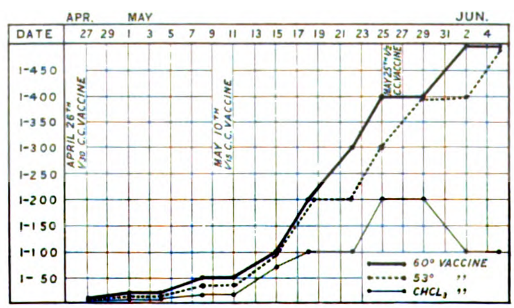


CHART IX.—Combined agglutination chart of the sera of three groups of rabbits which received doses of vaccine, killed by heat at 60° C. and at 53° C., and by chloroform. First dose, $\frac{1}{30}$ cc. on April 26; 2nd dose, $\frac{1}{15}$ cc. on May 10; 3rd dose, $\frac{1}{2}$ cc. on May 26.

(3) Normal rabbit corpuscles, 3 vols. Heated serum of vaccinated rabbits (53° C., vaccine), 3 vols. Emulsion of *B. typhosus*, 1 vol.	15″ at 37° C.	Average bacteria per phagocyte, 5.
(4) Normal rabbit corpuscles, 3 vols. Heated serum of vaccinated rabbits ($CHCl_3$ vaccine), 3 vols. Emulsion of *B. typhosus*, 1 vol.	15″ at 37° C.	Average bacteria per phagocyte, 4·4.

Control Experiments as to the normal bactericidal power of rabbit serum (six experiments) gave the average dilution, which was effective on a 1—10,000 dilution of a twenty-four hour broth culture of typhoid bacteria, as 1—20, the lowest being 1—5 (twice) and the highest 1—40 (once). The effect of the addition of one volume of a 1—5 diluted rabbit serum to a mixture of human serum, human corpuscles and emulsion of typhoid bacteria was, in every case, to lower the phagocytic index slightly, but the effect was no more than could quite well be explained by the dilution effected in the human serum by the addition.

Fourth Experiment.—This was done to see if the filtrate from an autolysed culture of typhoid bacilli, which had been killed by toluol, had any value as a vaccine. An emulsion was made by adding 1 cc. saline to each of several twenty-four hour agar growths of a virulent culture of *B. typhosus;* after being killed by toluol, it was allowed to autolyse and was then filtered through a Kitasato candle. The resulting fluid, which was of a clear, bright yellow appearance, was collected in glass capsules and hermetically sealed; after two days it was found to be slightly turbid and contamination was suspected, more especially when, later on, flocculi appeared in the tube; cultures were made from the filtrate, both anaerobically and aerobically, and they proved to be sterile, while microscopic examination of the fluid gave no evidence of the presence of micro-organisms, either bacteria or yeasts, both of which were suspected. It was evident, therefore, that the turbidity was due to a precipitation of some of the probably albuminous material contained in the fluid; what the exact nature of the process is and what influence, if any, it has on the vaccinating properties of the filtrate has, so far, not been ascertained.

Two well-grown rabbits were given each 1 cc. of the fluid hypodermically on September 11th, and a further dose of 2 cc. on October 5th. The inoculation was not followed by any apparent alteration in the health of the animals.

In the subsequent observations a modification was introduced

by comparing the bactericidal power of the grouped sera of the two vaccinated rabbits with the results of a simultaneous observation on the grouped sera of two normal rabbits; one is able, in this way, to construct a curve from which the variations due to accidental circumstances have been more or less obliterated, and thus to obtain a more just appreciation of the effect of the inoculation on the rise and fall of the bactericidal power of the serum

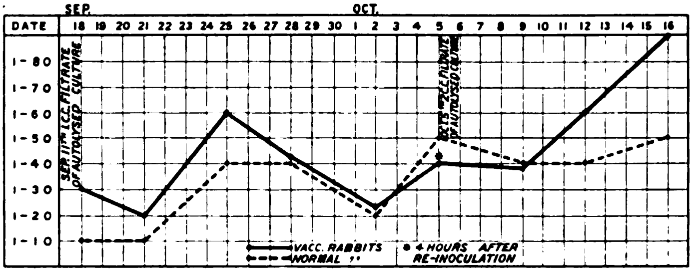


CHART X.—Comparative chart of the bactericidal action of the grouped sera of two rabbits, inoculated on September 11 and October 5 with the filtrate of an autolysed emulsion of *B. typhosus*, which had been killed by toluol, and of the grouped sera of two normal rabbits.

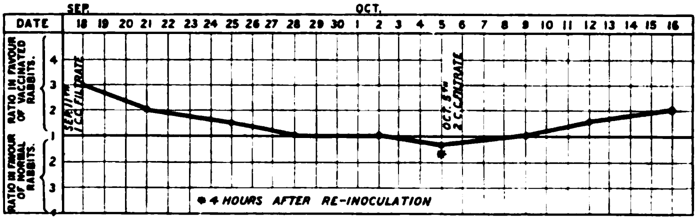


CHART XI.—Curve showing the rise and fall of the bactericidal action of the sera of two rabbits which had been inoculated with filtrate of an autolysed emulsion of *B. typhosus*, the bactericidal action of the grouped sera of two normal rabbits being treated as unity.

as compared with normal serum tested under the same conditions. It will be seen (chart No. XI.) that the sera of the vaccinated rabbits exercised its highest bactericidal properties on the seventh day (so far as was observed), and after that there was a steady drop to normal. After reinoculation there was some evidence of a fall below normal in the bactericidal action of the serum, and after that it rose, and was rising at the time the experiment was discontinued. It will be seen (charts X. to XIII.) that agglutinins were late in appearing and did not reach any great amount (in

this respect the vaccine resembled the chloroformed vaccines). There was a sudden drop in agglutinins as a result of reinoculation, and they subsequently rose again; but, so long as the experiment continued, they never rose to any great height. In the "stimulin" experiments, in order to obviate accidental differences in the readings, the experiments were done in duplicate, using different emul-

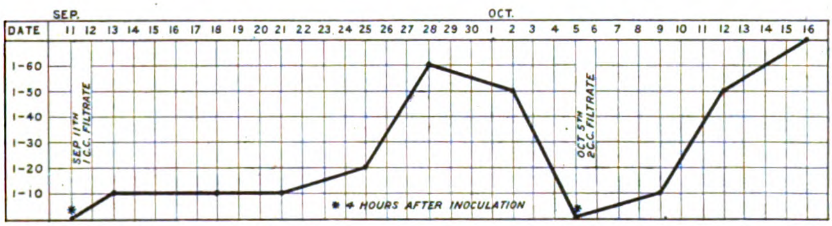


Chart XII.—Agglutination Chart (on an enlarged scale) of the grouped sera of two rabbits who were inoculated with filtrate of an autolysed culture of *B. typhosus* on September 11 and October 5.

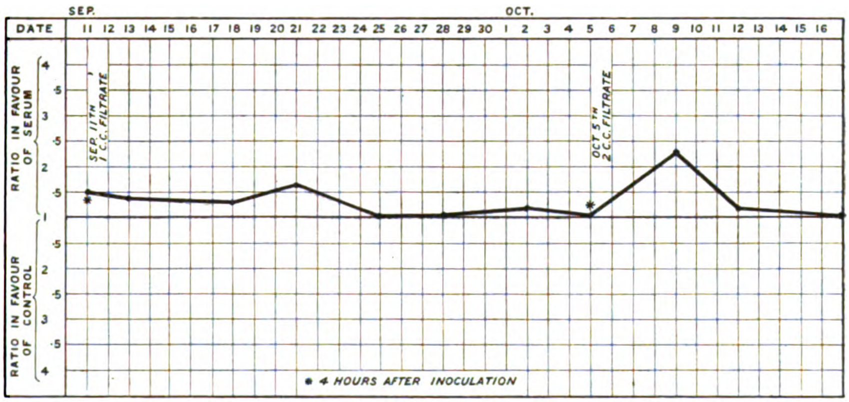


Chart XIII.—"Stimulin" action of the grouped sera of two rabbits which were inoculated with the filtrate of an autolysed culture of *B. typhosus* on September 11 and October 5.

sions, and the contents of not less than fifty cells were counted in each case, the result being stated as an average of the counts of the two experiments. The results in all cases were that the two experiments of each duplicate series confirmed each other. It will be seen that there is a sudden appearance of a stimulin action of the serum four hours after inoculation, just as occurred after the use of the chloroformed vaccine; that this stimulin action of the sera of the vaccinated rabbits lasted till the fourteenth day, when

it disappeared, and that reinoculation with a larger dose was not immediately followed by a reappearance of the substances which produce the stimulin phenomenon; when they did appear they lasted for only a short time and then disappeared altogether.

In another experiment made for the purpose of comparing the vaccinating properties of chloroformed cultures and those killed by toluol (unfiltered), the result was that whereas the injection of chloroformed culture caused the same rise of bactericidal power, &c., as in previous experiments with this substance, the serum of those rabbits which had been inoculated with toluol-killed cultures (unfiltered) showed a gradual and progressive decline in bactericidal power till, in the end, the serum showed no bactericidal power whatever. It is possible that this was due to extreme activity of the toluol-killed culture, which may have produced a prolonged "negative phase." Further experiments are necessary, however, before one can form a definite opinion on the subject.

Fifth Experiment.—The object of this experiment was to ascertain whether the swallowing of an emulsion of typhoid bacilli in glycerine would result in the formation of protective substances in the blood of man. The subject of the experiment (W. S. H.) had been inoculated a year previously with anti-typhoid vaccine, and his serum still gave evidence of this; the bactericidal power was effective in a dilution of 1—70 (normal 1—20) and agglutinins in a dilution of 1—200 (maximum); but the serum gave a phagocytic index no higher than normal, and showed no evidence of stimulins when added in small quantity to a mixture of normal serum, blood cells and bacteria.

An emulsion in sterile neutral glycerine was made from a mixture of virulent and avirulent growth of *B. typhosus* on agar, using 1 cc. for each agar slope. The emulsion was found to be sterile at the end of twenty-four hours, and as soon as sterility was confirmed doses commencing with 0·1 cc., and gradually increasing to 0·75 cc., were swallowed, daily at first and later every two or three days, until in all 4·5 cc. had been taken; the doses were swallowed as far as possible on an empty stomach.

The only symptoms that were noticed were very slight mental confusion, coming on about half an hour after the larger doses and lasting about an hour; this would not have been noticed had one not attempted at the time to do some arithmetical calculations. Samples of blood were taken fourteen days after the first dose and two hours after the last dose, and the serum was tested for the phagocytic ratio as compared with normal serum. It was found to

be + 2·4. This rise in the phagocytic ratio persisted for eight days and was accompanied by evidence of stimulins, as tested by Leishman's method; a week later it was found to have disappeared, and did not return although three further doses, amounting in all to 1·9 cc., were swallowed. There was a rise in the bactericidal power of the serum up to a maximum of 1—110 as compared with a normal of 1—10, this being found fifty-two days after the commencement of the treatment, and two months later the bactericidal power of the serum was active in a dilution of 1—80 as compared with a normal of 1—10. There was no rise in agglutinins, which remained at the point at which they were before treatment was commenced.

In order to see whether this was due to a destruction of the agglutinogens by the glycerine, a dose of 1 cc. of the glycerine emulsion was given to a guinea-pig hypodermically, and seventeen days later its serum was found to agglutinate typhoid bacilli in a dilution of 1—100; it is therefore probable that the absence of a rise in the agglutinins was due to the method of administration of the vaccine.

Sixth Experiment.—This was a repetition of the last experiment, this time on a normal man (T. H. G.) His blood had served as a "normal control" on several occasions, and was found to be bactericidal for typhoid bacilli in a dilution of 1—10; it contained no agglutinins for *B. typhosus*, it gave a normal phagocytic ratio and showed no evidence of the presence of stimulins.

An emulsion in glycerine of typhoid bacilli prepared as in the previous experiment, was administered by the mouth in gradually increasing doses, commencing with a small dose of 0·05 cc. (= 0·05 agar growth) and increasing to a maximum of 0·75 cc. (= 0·75 agar growth). Care was taken to give the emulsion as far as possible on an empty stomach.

No symptoms were observed except on one occasion, when, after a dose of 0·5 cc. of a glycerine emulsion of a virulent strain, there was headache of a mild type, and some diarrhœa later in the evening. It turned out afterwards, however, that two other men living in the same hotel had also been attacked by diarrhœa that evening, and a repetition of the same dose did not cause any untoward symptoms. The result of the experiment was that there was a marked rise in the bactericidal power of the patient's serum, as is seen on the accompanying charts (XIV. to XVI.), reaching a maximum of six times normal a month after commencing treatment, and ending up at the conclusion of the experiment two and a-half times greater than normal. In this experiment, also, there

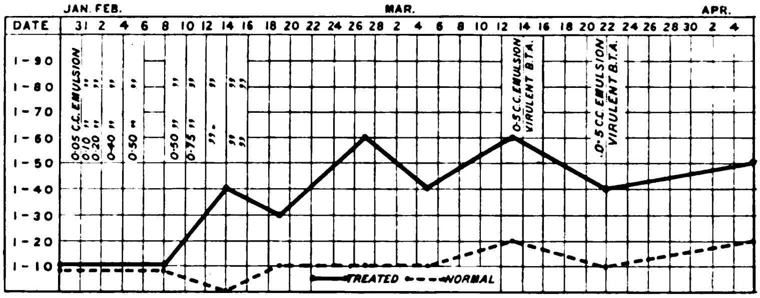


CHART XIV.—Bactericidal action of the serum of a normal man (T. H. G.) after swallowing a glycerine emulsion of *B. typhosus*, compared with the bactericidal action of the sera of two normal men.

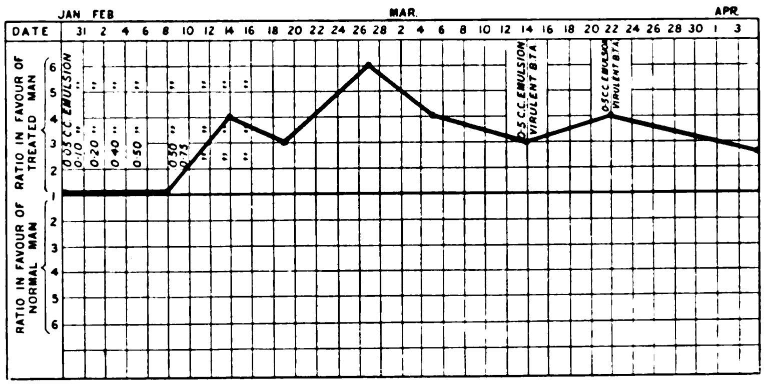


CHART XV.—Curve showing the rise and fall of the bactericidal action of the serum of a normal man (T. H. G.) after swallowing a glycerine emulsion of *B. typhosus*, the grouped sera of two normal men being taken as unity.

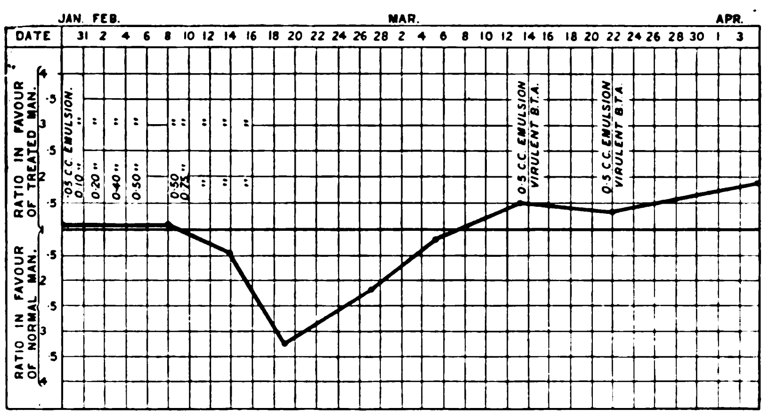


CHART XVI.—Phagocytic ratio of the serum of a normal man after swallowing a glycerine emulsion of *B. typhosus*, the grouped sera of two normal men being taken as unity.

was very little formation of agglutinins, which rose to a maximum of 1—30 on March 5th and ended up at 1—20 (incomplete reaction). The phagocytic ratio was depressed during the whole time that the emulsion was being taken and for nineteen days thereafter, it then recovered and rose above normal, where it remained until the conclusion of the experiment. There was no evidence of stimulins (except on one occasion) whilst the phagocytic ratio remained in the negative phase, and very little afterwards. In this respect the results of this experiment differ from those of the preceding one, where the evidence of the presence of stimulins in the serum was very marked. It may be that this was due to overdosing of the patient. The results of the two experiments, as well as those of a third, which was unfortunately incomplete, are promising, and further research in this direction is now in progress.

On the Duration of the Immunity resulting from the Injection of Anti-Typhoid Vaccine.

First Experiment.—The bactericidal action on *B. typhosus* of the serum of a man inoculated one year previously was compared with that of a normal man; the result showed that in the case of the vaccinated man his serum was bactericidal to typhoid bacilli in a dilution of 1—80, whilst normal serum killed in a dilution of 1—20; the serum of the vaccinated man likewise gave an agglutinin reaction in 1—200 dilution, and the phagocytic index was the same as normal.

Second Experiment.—An estimation of the anti-tropic substances contained in their blood was made on two groups of six men of the 7th Hussars, who had been inoculated four years previously, and had subsequently served in South Africa; the normal control serum was the pooled sera of six men of the same regiment who had the same service and had served under the same conditions as the inoculated men. The first group of inoculated men consisted of those men who had a severe reaction at the time of inoculation, and the second group of those who had only a mild reaction. The results are shown in the following table :—

Bactericidal Action—

Count	Serum	1—10	1—20	1—30	1—40	1—50	1—60	Control
860 millions per cc.	Normal ..	0	+(2)	+(7)	+(6)	+(11)	—	About 350 colonies
	Group 1 ..	0	0	0	0	0	+(1)	
	Group 2 ..	0	0	0	0	+(3)	0	

0 = sterile; + = growth (with number of colonies); — = not tried.

Agglutinins—
Normal = 1—10 complete
Group 1 = 1—30 not complete
Group 2 = 1—20 complete

Phagocytic Index—
Normal = 16·7
Group 1 = 16
Group 2 = 16·6

The presence of agglutinins in the normal group serum may have been due to the presence in the group of a man who had suffered from an unrecognised attack of typhoid fever. The culture with which the experiment was made was checked with other normal sera, and was not agglutinated by them in dilutions of 1 in 5 upwards.

Third Experiment.—The previous experiments were repeated, this time on the serum of an officer of the 7th Hussars who had been inoculated four years previously. The normal control serum was the pooled sera of two normal men (officers). The results were as follows:—

Bactericidal Action—

Count	Serum	1—10	1—20	1—30	1—40	1—50	1—60	Control
852 millions per cc.	Normal ..	0	+(5)	+(6)	+(2)	+(8)	+(31)	About 400 colonies
	Vaccinated	0	0	0	0	+(2)	+(6)	

0 = sterile, + = growth (with number of colonies).

Agglutinins—
Normal = *nil* in 1—5
Vaccinated = 1—30 complete

Phagocytic Index—
Normal = 10·8
Vaccinated = 9·5

Fourth Experiment.—The serum in this case was that of an officer who had been inoculated six years previously, and had never had typhoid fever. He had served in Egypt (war), Crete and the Punjaub. The control serum was taken from an officer who had never been inoculated or had typhoid fever; he had served in West Africa and South Africa (war). The results were as follows:—

Bactericidal Action—

Count	Serum	1—10	1—20	1—30	1—40	1—50	1—60	Control
920 millions per cc.	Normal ..	0	0	+(1)	+(7)	+(8)	+(17)	About 400 colonies
	Vaccinated	0	0	0	0	+(11)	0	

0 = sterile, + = growth (with number of colonies).

Agglutinins—
Normal — *nil* in 1—10
Vaccinated = 1—20 complete

It would appear, then, from the above experiments, that evidence of a bactericidal activity higher than normal and of the presence of agglutinins, can be obtained from the serum of men who have been inoculated as long as six years previously, but whether the protection that remains would still suffice to ward off an attack of typhoid fever is not yet known. The persistence of agglutinins was not expected, and is not without importance from the clinical point of view.

On the Protective Action of Different Vaccines Against Multiple Lethal Doses of a Virulent Typhoid Culture.

The virulent culture used for this experiment was one which was obtained from the Lister Institute in October, 1904. At that time it was fatal within twenty-four hours when given to guinea-pigs intraperitoneally in a dose of 0·5 cc. per 250 grammes weight. Since its receipt it had been kept in agar stab in a sealed tube. Broth cultures were made from this and tested for virulence after twenty-four hours' growth at 37° C. with the following results :—

	Weight of G.P.	Dose Intraperitoneally	Result
1	615 grammes	2·5 cc.	Died (under 20 hours).
2	465 grammes	1 cc.	Died (27 hours).
3	350 grammes	0·7 cc.	Died (under 22 hours).
4	260 grammes	0·5 cc.	Died (under 20 hours).

It appeared, then, that this culture could be relied on to kill guinea-pigs within twenty-four hours when given intraperitoneally in a dose of 0·5 cc. per 250 grammes.

Guinea-pigs were vaccinated with cultures of *B. typhosus* killed by heat at 60° C. and at 53° C., and by chloroform, the vaccine in each case being of precisely the same strength, and the dose given being 0·1 cc. per 100 grammes of guinea-pig.

First Experiment.—A group of vaccinated guinea-pigs, along with one normal one as a control, were given test doses of 1 cc. virulent culture per 250 grammes, intraperitoneally, twenty-two days after vaccination. The test culture was a particularly thin one, having been made directly from an agar stab; the result was that all the animals survived, including the control.

Second Experiment.—The above experiment was repeated, this time taking the precaution to pass the test culture once through broth so as to get a growth of average strength. The test dose of

1 cc. per 250 grammes was given twenty-seven days after vaccination. The result was that the control animal died in less than twenty-one hours, and *B. typhosus* was found in pure culture in its heart-blood. All the vaccinated guinea-pigs survived.

Third Experiment.—The test dose was given forty-three days after vaccination, the dose being 1·5 cc. per 250 grammes. The result was that all the animals survived, including the control. This was probably due to the fact that the virulent test culture had been subcultured daily for a fortnight and had thus lost a good deal of its virulence. It had not been anticipated that the virulence would disappear so rapidly during a series of sub-cultures.

Fourth Experiment.—The test dose was given eleven days after vaccination, the dose being 1·5 cc. per 250 grammes. The culture used was one made after one passage through broth from an agar stab (in which the bacterium seems to retain its virulence practically unaltered for some months). The result was that all the animals died within twenty hours, except the one which had been vaccinated with a culture killed by chloroform; this one survived. Typhoid bacteria were recovered in pure culture from the heart-blood of the animals which died.

Fifth Experiment.—In this the test dose was reduced to 1 cc. per 250 grammes, in the hope that one might find out some further differences in the protective properties of the three different vaccines. The dose was given twelve days after vaccination, and all the vaccinated animals survived; the control died within twenty hours, and *B. typhosus* was recovered in pure culture from its heart-blood.

Sixth Experiment.—In this the test animals were given two doses of $\frac{2}{10}$ cc. vaccine per 100 grammes at an interval of eleven days, this followed by a dose of four times that quantity, the idea being to see if one could establish any differences in the protective powers of the different vaccines by raising the immunity to a fairly high level. The test dose of 2 minimum lethal doses was given thirteen days after the last dose of vaccine; the result was that the control died in under twenty hours and the vaccinated animals all survived. *B. typhosus* was recovered in pure culture from the heart-blood of the control.

Seventh Experiment.—The animals were vaccinated in the same way as in the last experiment, and a test dose of 10 minimum lethal doses was given fourteen days after the last dose of vaccine, the control getting a single lethal dose. The result was that all the vaccinated animals survived, whereas the control died within twenty-four hours and typhoid bacilli were recovered in pure culture from its heart-blood.

So far as the attempt to discover differences in the protective value of the three different vaccines was concerned the results of these experiments are inconclusive, but they show that a dose of $\frac{1}{10}$ cc. per 100 grammes of a culture killed by any of the three methods which were tried, will protect a guinea-pig against twice a lethal dose of *B. typhosus*, and that, if one repeats the doses of vaccine, one can protect a guinea-pig against at least ten times a lethal dose.

Addition of Antiseptics to Vaccine.—The following experiments were made to determine the smallest quantity of lysol which could be relied on to prevent the growth of accidental contaminations, should any occur in the vaccine.

Broth containing various quantities of lysol was inoculated with (1) *Staphylococcus aureus*, (2) *Bacillus typhosus*, (3) *B. mesentericus*, (4) *B. tetani* (in this last case glucose broth was used and the cultures made anaerobic). Measured volumes of the infected lysol broth were taken at intervals and mixed with melted agar (at 43° C.), and note was taken of the number of colonies which grew as compared with control specimens taken immediately after infecting the lysol broth. The results were as follows:—

(1) *S. aureus* increased in $\frac{1}{20}$ per cent. to $\frac{1}{10}$ per cent. lysol-broth and failed to grow in $\frac{1}{8}$ per cent. lysol-broth; at the end of three days this last was sterile.

(2) *B. typhosus* behaved in the same way as *S. aureus*.

(3) *B. mesentericus* and *B. tetani* had failed to grow in $\frac{1}{20}$ per cent. lysol-broth after three days' incubation.

It appeared, then, that $\frac{1}{8}$ per cent. lysol is quite sufficient to prevent growth of any of the organisms tried, and in the vaccine which is now issued $\frac{1}{4}$ per cent. lysol is added, leaving a margin for safety.

Observations were made on the fate of any organisms accidentally added to a bottle of vaccine containing $\frac{1}{4}$ per cent. lysol, capped in the usual way and kept at 37° C. The organisms used were *Staphylococcus*, *Streptococcus*, *Torula* and *B. subtilis*; the result was that not only did none of the organisms grow, but at the end of five days the vaccine had purified itself completely. Another experiment of the same kind where, among other organisms, *B. tetani* was used, gave the same result. In a third experiment the vaccine was contaminated with saliva; it was found sterile at the end of seven days. It appears, then, that with reasonable care in handling, a vaccine containing $\frac{1}{4}$ per cent. lysol can be trusted to be free from injurious contaminations.

REPORT ON THE OUTBREAK OF ENTERIC AND EFFECT OF ANTI-TYPHOID INOCULATION AMONG THE 17TH LANCERS, MEERUT, INDIA.

By Lieutenant E. J. H. LUXMOORE.
Royal Army Medical Corps.

Anti-typhoid inoculation among the 17th Lancers was carried out by me, partly in Scotland, during the latter end of August, 1905, and partly on the voyage out, in September, 1905.

	Strength of Regiment on Embarkation, September 6th, 1905.	Number Inoculated in Scotland, and on Voyage, August and September, 1905. First Dose	Second Dose
Officers..	19	17	16
Their wives	5	3	3
Non-commissioned officers and men	490	130	108
Women and children	79	0	0
	593	150	127

Of the 150 inoculated no less than twenty-three refused to have the second dose, on the excuse that it hurt them, or that they did not believe in it, and no amount of persuasion would make them submit to it.

On December 2nd, 1905, a draft of the regiment disembarked at Bombay and joined headquarters. Strength: Officers, 1; non-commissioned officers and men, 91; women and children, 4; total, 96. Some of these men had been inoculated before arrival; exact number not known, as nominal roll has not arrived yet.

Enteric broke out in the regiment a few weeks after our arrival, and fresh cases have been admitted every month, with the exceptions of January and March, 1906, and during these months there were some cases under observation for enteric.

The men inoculated were of all ages and evenly distributed among the four squadrons. Of the 130 non-commissioned officers and men inoculated 117 are under 25 years of age. The majority of the regiment consists of men between 20 and 25.

Clinical Effects and Degrees of Discomfort caused by the Inoculations.

First dose, ·5 cc. (F., August 4th, 1905).—All the cases I saw complained of local and constitutional symptoms of varying degrees, first noticed three or four hours after inoculation.

The local symptoms consisted of redness at site of inoculation,

swelling, from varying degrees of serous exudation, pain and tenderness. There was some lymphangitis in a few cases, and enlarged glands in groin or axilla in some cases.

The constitutional symptoms consisted of malaise of varying degrees, nausea—a few cases actually vomited, but these occurred on the voyage and were probably due to sea-sickness—fever, varying between 99° and 101° F., headache and loss of appetite.

The constitutional symptoms only lasted over thirty-six hours in the case of an officer who suffered more than any one else; he remained in bed for forty-eight hours with rather a severe type of the above symptoms. Fever rose to 101° F. He got up, however, at the end of forty-eight hours, and the following morning was feeling quite well again. This same officer was inoculated against enteric on his way out to the South African War, and says that at that time he felt the effects of the inoculation more than any one else on the boat. Of the seventeen officers inoculated only one other remained in bed the following day; he complained of a slight headache, nausea, loss of appetite, and his temperature rose to 100° F.; he also complained of severe pain and tenderness at site of inoculation.

Second dose, 1 cc. (F., August 4th, 1905), was given after an interval of ten days or more. Nearly every person who received the second dose complained of some local pain and tenderness at site of inoculation, which the majority said was not to be compared to that following the first dose, the local symptoms being so mild and the constitutional symptoms hardly noticeable. There were a few who said that they were worse in every way than they were after the first dose, and there were some who said they felt absolutely nothing of it at all.

Short History of Regiment from date of leaving England, 1905. —September 6th, embarked at Southampton. Strength: Officers, 19; non-commissioned officers and men, 490. September 28th, disembarked at Bombay; September 29th, Deolali Rest Camp; October 2nd, Jhansi Rest Camp; October 4th, arrived at Meerut; segregated in rest camp, about half a mile north-west of the British Cavalry Barracks, which were still occupied by the 4th Hussars. The married families, "A" Squadron and half of "D" Squadron, occupied bungalows, the remainder were under canvas. October 6th, the 17th Lancers took over stables and horses from the 4th Hussars, and from this date many men used latrines in the 4th Hussars' lines. Twelve cases of enteric had been admitted from the 4th Hussars in August, 1905. Date of last admission, August 31st, 1905.

October 10th, 4th Hussars left British Cavalry Barracks. October 8th to October 13th, diarrhœa very prevalent among 17th Lancers. October 19th to October 22nd, diarrhœa again prevalent. October 24th to November 4th, a mixed detachment of 112 non-commissioned officers and men of the 17th Lancers absent at Delhi on escort duty, twenty-eight men from each squadron. During this time three of these men were admitted to Delhi Hospital with enteric. November 1st, regiment moved into barracks from rest camp, the barracks having been thoroughly cleaned out and re-whitewashed. November 4th, Delhi detachment returned. December 1st, dry earth abolished in all latrines, and 2 per cent. carbolic acid solution substituted. Water substituted for carbolic about middle of January, 1906, for septic tank.

Causation.—Very few of the early cases appear to have gone out of their lines; a few had been to the Soldiers' Home, but none would admit having had food or drink from any native hawker.

The bedding was obtained as follows: Each man was given a new blanket at Deolali; after reaching Meerut, on October 4th, each man received two extra blankets from the Divisional Store Depôt. These were not new, but had been washed since previous issue; their history could not be traced. The men accommodated in bungalows in rest camp ("A" and half of "D" Squadrons), received mattress cases and coir from the stores of the Quartermaster, 4th Hussars, the cases being either new or washed, the coir being part new and part old. The men who were under canvas at the rest camp slept on "charpoys," and did not receive mattresses until they went into barracks on November 1st, when each squadron took over the mattresses, pillow-cases and coir of the corresponding squadron of the 4th Hussars. All mattresses and pillow-cases were washed before being taken into use. The regimental institutes, mineral water factory, dairy, &c., are under regimental supervision, and are kept very clean.

Flies were very prevalent at the rest camp, and in barracks, at the time of the greatest number of admissions, but as soon as the carbolic was used in the latrines instead of dry earth, the number of flies, and the admissions for enteric, diminished fairly rapidly. About 25 per cent. of the cases showed signs of early bronchitis, indicating the possibility of infection by dust.

Seventeen cases of enteric fever occurred among the 112 men who went to Delhi; three cases were admitted to hospital at Delhi within nine days of their arrival; six cases were admitted to Meerut Hospital within fifteen days of their return from Delhi, *i.e.*,

November 4th to November 18th, and three subsequently, who had been feeling unwell on or before November 16th. These nine latter cases may have contracted the disease at Delhi.

With regard to squadron prevalence, the cases, up to the end of 1905, were very evenly distributed.

		Cases.
"A" Squadron	.. ..	12
"B" ,,	.. ..	9
"C" ,,	.. ..	12
"D" ,,	.. ..	13

Of the forty-six cases which occurred up to the end of 1905, only three occurred in men over 25 years of age, and these three men were 26 years of age. In the Appendix is given a summary of all the enteric cases in tabular form; the several numbers correspond to the numbers opposite the dots in the spot map. The notes and charts of Troopers C. and R., the only men inoculated against enteric, are appended; both were men who refused the second inoculation. The majority of the bacteriological work was carried out by the medical officer in charge of the Divisional Laboratory.

Extract from the Sanitary Report, Meerut, 1905, by Senior Medical Officer, Meerut:—

(1) Meerut had 108 admissions and twenty-two deaths from enteric, as compared with eighty-five admissions and twenty-two deaths during last year.

(2) This year the disease had not been so prevalent at this station until October to December, when fifty-one cases occurred out of the total 108 for the whole year; forty-three out of the fifty-one occurred among the 17th Lancers.

(3) The source of infection could not be definitely made out, but its spread was probably favoured by dust, flies, latrines and urinals.

The proximity of native villages, bazaars and "syce" lines, to the regimental lines, and the constant intercourse which takes place between them, may have a good deal to do with the causation of this disease. The barrack clothing, bedding, &c., of enteric patients have always been strictly disinfected, according to regulations, as well as the barrack rooms themselves, latrines, urinals, &c. Every suspected case of the disease was treated as regards isolation, disinfection of clothing, barracks, &c., in exactly the same manner as a pronounced case of the disease.

(4) Several of the cases occurred while the men were still segregated in tents after their arrival, and before they had gone into the permanent Cavalry Barracks.

APPENDIX I.

17th LANCERS.

Appendix to Annual Report of Medical Transactions and Prevailing Diseases at Station Hospital, Meerut.

***Enteric Fever*— *October to December*, 1905; *January 1st to June 2nd*, 1906.**

No.	Rank and name	Squadron	Age	Dates of Arrival		Dates of		Date of onset of fever	Duration of fever in days	Complications with Dates									Eruption, with date	Diarrhœa or constipation	Whether inoculated, with dates	No. of Barrack Room	No. of days
				India	Station	Admission	Final result			Pneumonia	Bronchitis	Early delirium	Hæmorrhage	Perforation	Epistaxis	Thrombosis	Phlebitis	Other complications				Rest camp, 4.10.05 to 1.11.05; barracks, 1.11.05; Delhi squad., 24.10.05 to 4.11.05	
1	Pte. B...	B	24	28.9.05	4.10.05	26.10.05	R., 20.1.06	23.10.05	20	..	3.11.05	..	17.11.05	..	..	..	..	..	31.10.05	Constipation	No	B5 tent	8
2	L.-C. l. G.	B	22	,,	,,	28.10.05	R., 13.1.06	25.10.05	14	..	28.11.05	..	6.11.05	..	1.11.05	..	..	..	4.11.05	Diarrhœa ..	,,	,, ...	7
3	Pte. N..	A	20	,,	,,	30.10.05	R., 13.1.06	26.10.05	25	..	..	..	..	..	..	..	..	Retention of urine, 4.11.05	..	,,	,,	Rest camp A, bungalow	7
4	,, W..	D	22	,,	,,	7.11.05	Inv., enteric leg, 20.3.06	6.11.05	25	..	11.11.05	8.11.05	..	..	8.11.05, 7.11.05	17.12.05	16.12.05	Sore throat, 7.11.05	7.11.05	Early diarrhœa, then constipation	,,	9, for a few days, bed 65, D8 tent	13
5	,, J...	D	20	,,	,,	29.10.05	R., 13.1.06	28.10.05	29	..	..	Yes	Yes	..	Yes	..	..	Severe nervous complicat'ns, delusions, &c.	2.11.05	Diarrhœa ..	,,	Delhi tent D1, Rest camp D, bungalow	7
6	,, H...	D	19	,,	,,	1.11.05	R., 13.1.06	29.10.05	10	..	6.11.05	3.11.05, 2.11.05	..	..	..	..	..	..	5.11.05	Constipation	,,	9, for a few days, bed 10, Rest camp D bnglw.	7
7	,, C...	A	23	,,	,,	31.10.05	R., 22.12.05	30.10.05	12	..	..	..	..	..	..	..	..	..	4.11.05	,,	,,	Delhi tent A1, Rest camp A bungalow	5
8	,, McB.	C	23	,,	,,	3.11.05	D., 10.11.05	,,	11	..	11.11.05	..	8.12.05	..	..	..	..	Incontinence of urine and fæces, vomitg.	,,	Diarrhœa ..	,,	8, bed 37 for 2 or 3 days. Rest camp tent C8	[illegible]
9	,, W..	A	24	,,	,,	,,	R., 20.2.06	29.10.05	39	21.11.05	8.11.05	5.11.05 to 15.11.05	..	..	..	..	..	..	..	Early diarrhœa, then constipation	,,	2, bed 2 for a few dys. Rest camp A bungalow	11
10	,, T...	D	23	,,	,,	2.11.05	R., 22.12.05	1.11.05	14	..	..	..	..	..	..	..	..	Deafness for some time	9.11.05	Diarrhœa ..	,,	Delhi tent D1, Rest camp, tent D2	5
11	,, B...	C	21	,,	,,	10.11.05	R., 16.2.06	6.11.05	R* 4 32	..	26.11.05	..	..	..	..	..	..	Sore throat, 10.11.05	25.11.05	Constipation	,,	5, bed 23 for a few days. Rest camp, tent C4	9
12	,, B...	C	23	,,	,,	7.11.05	D., 19.11.05	7.11.05	12	..	11.11.05	13.11.05	3 large hæmgs., 15.11.05	..	11.11.05	..	..	..	..	Diarrhœa ..	,,	5, bed 19 for a few days. Rest camp, tent C4	[illegible]
13	,, W..	C	20	,,	,,	8.11.05	D., 20.11.05	6.11.05	15	9.11.05	7.11.05	9.11.05	..	..	..	..	..	..	..	Constipation	,,	5, bed 34 for a few days. Rest camp, tent C9	[illegible]
14	,, H..	C	22	,,	,,	10.11.05	R., 31.1.06	9.11.05	20	..	16.11.05	..	..	..	..	..	..	Sore throat, 10.11.05	18.11.05	,,	,,	5, bed 15 for a few days. Rest camp, tent C5	8
15	Cpl. K...	A	24	,,	,,	12.11.05	R., 31.1.06	12.11.05	19	..	20.11.05	13.11.05	..	..	..	..	..	..	16.11.05	Early diarrhœa, then constipation	,,	1, bed 68 for a few days. Rest camp A bnglw.	8
16	L.-Cpl. R.	B	22	,,	,,	8.11.05	R., 18.1.06	4.11.05	16	8.11.05	5.11.05	9.11.05	..	..	..	..	..	..	14.11.05	Constipation	,,	4, bed 26. Rest camp, tent B9	7
17	Pte. D...	D	24	,,	,,	13.11.05	R., 20.2.06	13.11.05	26	..	..	..	..	..	..	..	..	..	23.11.05	Diarrhœa ..	,,	10, bed 12. Rest camp, tent D5	10
18	,, H...	B	22	,,	,,	18.11.05	R., 2.3.06	18.11.05	R* 5 32	..	18.11.05	4.12.05	..	..	..	..	..	Abscesses, pleurisy, 9.12.05	2.12.05	Diarrh. 3 wks., then constip.	,,	4, bed 21. Rest camp, tent B8	10

19	,, W...	B	22	,,	,,	16.11.05	R., 2.3.06	15.11.05	39	..	25.11.05	..	3 large hæmgs., 26.11.05, 30.11.05, 11.12.05	..	..	..	..	..	..	Diarrh., then constipation	,,	8, bed 19. Rest camp, tent B6	107
20	,, B...	A	24	,,	,,	,,	R., 20.2.06	14.11.05	31	..	14.11.05	23.11.05	..	..	.	..	..	..	..	Constipation	,,	1, bed 40. Rest camp A bnglw.	97
21	,, W...	B	22	,,	,,	18.11.05	R., 19.2.06	17.11.05	27	..	20.11.05	1.12.05	..	..	..	..	..	Delusions, 15.12.05; pleurisy, 29.11.05	..	,,	,,	4, bed 20. Rest camp, tent B8	94
22	,, B...	B	20	,	,,	15.11.05	R., 19.2.06	14.11.05	25	..	28.11.05	..	..	.	..	..	..	..	23.11.05	,,	,,	3, bed 31. Rest camp, tent B6	97
23	,, T...	A	23	,,	,,	16.11.05	D., 8.12.05	,,	25	..	8.12.05	..	30.11.05, 29.11.05, 28.11.05, 27.11.05	28.12.05	..	..	..	..	..	,,	,,	2, bed 1. Rest camp A bnglw.	23
24	,, R...	C	22	,,	,,	20.11.05	R., 20.2.06	20.11.05	R* 5 14	..	21.11.05	..	..	..	..	..	..	Ischiorectal abscess, 14.12.05	..	,,	,,	8, bed 8. Rest camp, tent C7	93
25	Cpl. B...	C	26	,,	,,	,,	R., 19.2.06	16.11.05	25	..	24.11.05	..	..	..	..	..	..	..	..	,,	,,	5, bed 25. Rest camp, tent C4	91
	Mrs. C...	—	26	,,	,,	18.11.05	R., 22.2.06	15.11.05	23	..	15.11.05	13.11.05	..	..	..	..	..	Mental delusions	..	Diarrhœa ..	,,	44, married qtrs. No. 7 bungalow	97
26	Cpl. M...	D	25	,,	,,	20.11.05	R., 20.2.06	18.11.05	23	..	..	..	..	..	..	..	..	Ague	..	Constipation	,,	9, bed 59. Rest camp D bnglw.	99
27	Pte. W...	A	22	,,	,,	,,	R., 20.2.06	19.11.05	27	..	..	..	..	..	..	..	..	..	30.11.05	,,	,,	2, bed 2. Rest camp A bnglw.	98
28	,, B...	B	24	,,	,,	22.11.05	R., 19.2.06	22.11.05	21	..	..	..	Dysent. stools	..	..	..	..	Tenesmus, bld. and mucus	..	Diarrhœa ..	,,	4, bed 59. Rest camp, tent B10	90
29	Cpl. J...	A	23	,,	,,	,,	Inv., enteric fev., 20.3.06	,,	28	..	22.11.05	..	..	..	..	5.1.06	1.1.06	Tender toes ..	29.11.05	Early diarrhœa then constipation	,,	1, bed 36. Rest camp A bnglw.	119
30	Pte. W...	D	29	,,	,,	25.11.05	R., 24.2.06	23.11.05	22	..	25.11.05	..	..	..	..	..	..	..	,,	Constipation	,,	9, bed 67. Rest camp, tent D4	92
31	,, P...	C	24	,,	,,	28.11.05	R., 27.2.06	20.11.05	21	..	..	..	..	..	4.12.05	..	..	..	6.12.05	,,	,,	14, band bnglw. Rest camp, tent C3	92
32	Cpl. R...	C	24	,,	,,	25.11.05	R., 20.2.06	23.11.05	25	..	4.12.05	..	..	..	..	..	..	..	6.12.05	Diarrhœa ..	,,	7, married qrtrs. No. 42. Rest camp, married quarters	88
33	Pte. D...	A	24	,,	,,	29.11.05	R., 20.2.06	27.11.05	21	..	..	..	..	..	..	..	..	..	..	Constipation	,,	1, bed 64. Rest camp A bnglw.	84
34	,, C...	B	21	,,	,,	25.11.05	R., 24.2.06	21.11.05	17	..	25.11.05	..	..	..	4.12.05, 25.11.05	..	..	Sore throat ..	..	,,	First dose only, 11.9.05	4, bed 23. Rest camp, tent B9	92
35	L.-Cpl M...	D	24	,,	,,	26.11.05	D., 3.12.05	25.11.05	9	..	3.12.05	..	2 very large hæmgs., 18.11.05, 26.11.05	..	3.12.05	..	..	1 large and several small liver abscesses	..	Diarrhœa ..	Yes No	9, bed 26. Rest camp, tent D4	8
36	Pte. A...	C	21	,,	,,	28.11.05	R., 20.2.06	28.11.05	R* 3 12	..	..	..	..	..	..	..	..	..	..	Constipation	,,	5, bed 47. Rest camp, tent C2	85
37	,, T...	C	22	,,	,	3.12.05	R., 28.2.06	,,	46	..	11.12.05	..	15.12.05	..	..	..	..	Feeble circulation	..	Diarrhœa ..	,,	8, bed 31. Rest camp, tent C	117
38	,, J...	A	24	,,	,,	6.12.05	R., 20.2.06	5.12.05	16	..	..	..	..	..	10.12.05, 5.12.05	..	..	..	10.12.05	Constipation	,,	Qmstr.'s stores. Rest camp A bungalow	77
39	,, J...	A	20	,,	,,	5.12.05	R., 2.3.06	2.12.05	29	..	15.12.05	..	..	..	..	..	..	..	..	,,	,,	2, bed 15. Rest camp A bnglw.	90
40	,, W.	D	22	,,	,,	10.12.05	Very severe case, inval. to Eng. 20.2.06	9.12.05	36	..	16.12.05	30.12.05 to 8.1.06	..	..	..	..	..	..	13.12.05	,,	,,	10, bed 30. Rest camp D bnglw.	101

* R = Relapse.

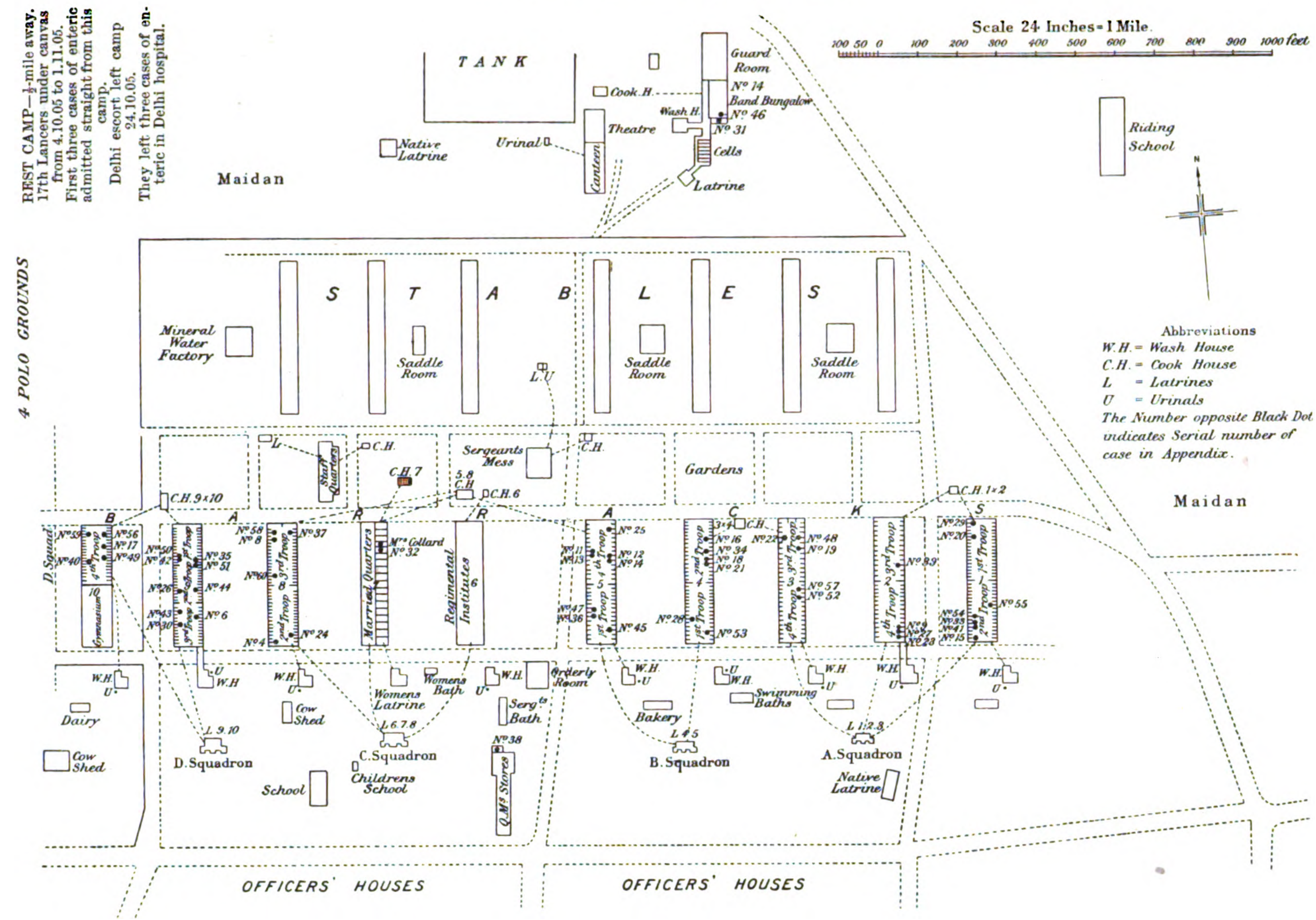
APPENDIX I.—*Continued.*

No.	Rank and name	Squadron	Age	Dates of Arrival: India	Dates of Arrival: Station	Dates of: Admission	Dates of: Final result	Date of onset of fever	Duration of fever in days	Complications with Dates: Pneumonia	Bronchitis	Early delirium	Hæmorrhage	Perforation	Epistaxis	Thrombosis	Phlebitis	Other complications	Eruption, with date	Diarrhœa or constipation	Whether inoculated, with dates	No. of Barrack Room (Rest camp, 4.10.05 to 1.11.05; barracks, 1.11.05; Delhi squad, 24.10.05 to 4.11.05)	No. of days in hospital
41	Pte. R...	A	23	28.9.05	4.10.05	3.12.05	D., 20.12.05	1.12.05	20	19.12.05	16.12.05	13.12.05	..	..	13.12.05	..	..	..	9.12.05	Diarrhœa ..	No	1, bed 65. Rest camp A, bunglw.	18
42	„ T...	D	21	„	„	13.12.05	R., 2.3.06	12.12.05	24	..	29.12.05	..	..	..	..	8. 1.06	5 1.06	..	21.12.05	Constipation	„	9, bed 49 ..	80
43	„ D...	D	26	„	„	16.12.05	R., 20.2.06	13.12.05	14	..	..	..	..	..	..	..	..	..	18.12.05	„	„	9, bed 63 ..	67
44	„ C...	D	23	„	„	18.12.05	Invald., change to Eng., 20.3.06	14.12.05	56	..	25.12.05	20 12.05	23.12.05, 21.12.05	..	28.12.05, 27.12.05, 26.12.05	..	..	Liver enlarged downwards; expl. with needle, nil found	..	Diarrhœa ..	„	9, bed 17 ..	93
45	„ B...	C	21	„	„	22.12.05	R., 17.3.06	17.12.05	15	..	..	..	..	..	..	..	..	..	25.12.05	Constipation	„	5, bed 4.. ..	86
46	„ H...	D	24	„	„	29.12.05	R., 1.4.06	23.12 05	R* 21 8	..	21.1.06	..	..	..	..	..	..	..	10.1.06	„	„	14, band bunglw.	94
47	„ P...	C	20	„	„	15.2.06	D., 13.3.06	15.2.06	26	..	20.2.06	24.2.06	4. 3.06 2. 3.06 1. 3.06	12.3.06	..	..	..	Peritonitis ..	26.2.06	Diarrhœa ..	„	5, bed 46 ..	26
48	„ McD.	B	22	„	„	22.4.06	D., 8.5.06	20.4.06	19	..	24.4.06	25.4.06	..	..	..	..	..	Severe toxæmia, bronchopneumonia	27.4.06	Constipation, later diarrhœa	„	3, bed 22 ..	17
49	„ L...	D	22	„	„	6.5.06	..	3.5.06	R* 10 12	..	..	..	..	..	..	..	3.6.06	..	12.5.06	Constipation	„	10, bed 8 ..	..
50	L.-Cpl. S.	C	23	1.1.06	3.1.06	7.5.06	D., 25.5.06	5.4 06	21	..	..	18.5.06	..	..	..	..	..	Sev. toxæmia, finally cerebral. Temp. 106° F.	14.5.06	Constipation, later diarrhœa	„	9, bed 47 ..	19
51	Cpl. S .	D	23	28.9.05	4.10.05	9.5.06	D., 18.5.06	7.5.06	12	..	12.5.06	15.5.06	..	..	..	..	..	Sev. toxæmia, hyperpyrexia 107·4°; broncho.pneumna	15.5.06	Diarrhœa ..	„	9, bed 24 ..	10
52	Pte. B..	B	22	2.12.05	5.12.05	11.5.06	..	9.5.06	20	..	..	..	..	..	18.5 06, 8.5.06	..	..	Persist. retention, 11.5.06	12.5.06	Constipation	„	3, bed 10 ..	..
53	„ W..	B	23	„	„	14.5.06	..	12.5.06	12	..	16.5.06	..	..	..	14.5.06	..	..	..	20.5.06	„	„	4, bed 3.. ..	..
54	„ R. †	A	20	„	„	13.5.05	..	11.5.06	..	..	23.5.06	2.6.06	..	..	..	..	2.6.06	Sev. pain in region of spleen 21.5.06	17.5.06	„	1.12.05 1 dose only Yes	1, bed 62 ..	..
55	„ A...	A	25	28.9.05	4.10.05	15.5.06	..	12.5.06	17	..	..	..	..	..	..	..	..	Abscesses, sciatica	„	„	No	2, bed 10 ..	..
56	„ M..	D	23	„	„	24.5.06	..	22.5.06	20	..	..	..	..	..	..	..	..	Early dry tong'e 25.5.03; reten. of urine, 26.5.06	..	„	„	10, bed 16 ..	..
57	„ McD.	B	21	2.12.05	5.12.05	„	..	„	..	..	..	..	..	..	26.5.06	..	..	..	4.6.06	„	„	3, bed 11 ..	..
58	Cpl. W..	C	22	„	„	26.5.06	..	25.5.06	..	..	..	..	..	..	28.5 06	..	..		28.5.06	„	„	8, bed 35 ..	..
59	S.-Sgt. L.	D	24	28.9.05	4.10.05	2.6.06	D., 8.6.06	30.5.06	10	..	..	7.6.06	..	..	1.6.06	..	..	Mening. symp., incont'ce of urine & fæces. Sore throat, vom., hyperpyrexia, 107°	..	Diarrhœa ..	„	10, bed 21 ..	7
60	Pte. L..	C	22	2.12.05	5.12.05	„	..	1.6.06	..	..	..	..	..	..	..	..	..	Retention of urine	..	Constipation	„	8, bed 46 ..	..

* R = Relapse. † Pte. R. subsequently recovered.

BLOCK PLAN OF B. C. LINES, MEERUT.

17th Lancers Enteric Spot Map, 1905-6.



(5) The drinking water in barracks and lines is supplied by the municipal waterworks from their filter-beds at Bhola, on the Ganges Canal, and is chemically and bacteriologically examined every fortnight in the Divisional Laboratory, and also by the Government Analyst at Agra, and has always been pronounced pure and free from contamination.

(6) The almost total failure of the rains in August and September, 1905, may have helped to produce this outbreak at the end of the year; the dust and flies were certainly much above the average at the season.

(7) The use of dry earth in the latrines was stopped, and a 2 per cent. solution of crude carbolic was used instead, starting on December 1st, 1905, with, apparently, good results.

(8) The Command Sanitary Officer made special investigations during the latter end of November, 1905, and after careful examination of barracks and all their surroundings, was unable to detect source of infection. He recommended the use of 2 per cent. solution of crude carbolic instead of the dry earth in the latrines.

Enteric fever subsided at the end of 1905, and there were no admissions during January, 1906, although there were several cases under observation for enteric.

The first case of enteric among the regiment in 1906 (No. 47), was admitted on February 15th. The disease was of a severe type, and the man died on March 13th, of peritonitis following perforation. No cause could be found for infection in this case.

The next case (No. 48) was not admitted until April 22nd. It was also very severe, and the man died seventeen days after admission. *Post mortem:* Extensive deep ulceration; no sign of perforation.

Nos. 50 and 51 were two very severe types of cases from the day of admission. They came in about the same date, and apparently they were both attacked with the same virulent strain of the organism, probably the same as attacked Case No. 48, although their blood did not give a positive reaction to Widal's test, while Case No. 48 did. Both men died of severe toxæmia, with cerebral symptoms and hyperpyrexia. *Post mortem:* In each case typical extensive typhoid ulceration of intestines; no perforation. Cultures from spleens sent to medical officer in charge of Divisional Laboratory showed the presence of Eberth's bacillus.

No. 54 is the case of a man who has been inoculated, first dose only. He came out in December, 1905, and was inoculated in Edinburgh, before embarkation, about December 1st (patient's

statement), as no nominal roll of cases inoculated in this draft has as yet arrived. Temperature chart and notes attached. Patient's blood did not give positive result to Widal's test, although examined five times, at intervals of six or seven days each.

No. 59 was a severe case, ending fatally, six days after admission, from toxæmia and hyperpyrexia; ninth day of disease. *Post mortem:* Extensive swelling of Peyer's patches; sloughs had not separated.

APPENDIX II.

ENTERIC FEVER AMONGST THE 17TH LANCERS IN INDIA,
October, 1905, *to June*, 1906.

	1905			1906					
	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
Admissions	5	32	10	0	1	0	1	10	2
Deaths	—	3	3	0	0	1	0	3	1

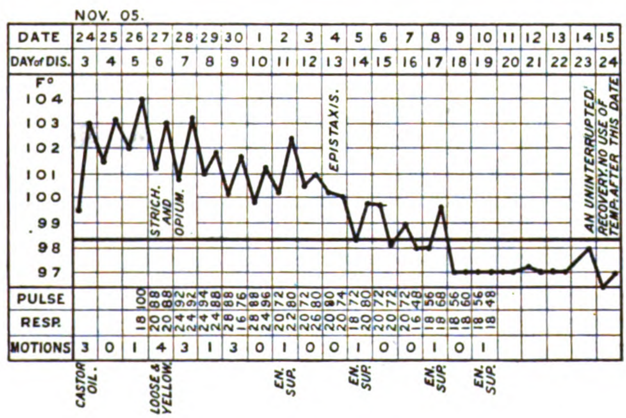
Arrived in India, September 28th, 1905. Arrived in Meerut, October 4th, 1905.

***Note*.—Since the date of this report a few more cases of enteric occurred in the regiment at intervals** during the remainder of 1906; none of these were in inoculated men. Detailed information not yet received. —W. B. LEISHMAN, *Lieutenant-Colonel, R.A.M.C.*

APPENDIX III.

MEDICAL CASE SHEET.

History of Case of No. 34, *Private C., aged* 21.—This man had been quite well up to November 21st, then had headache, slight pain in abdomen, no vomiting, nor diarrhœa. Detained at Station Hospital on



November 23rd. Admitted to No. 1 Section Hospital on November 24th, on which day he had slight epistaxis. Tongue coated, then white. Placed in observation ward for enteric. Milk, three pints; soda water, two bottles.

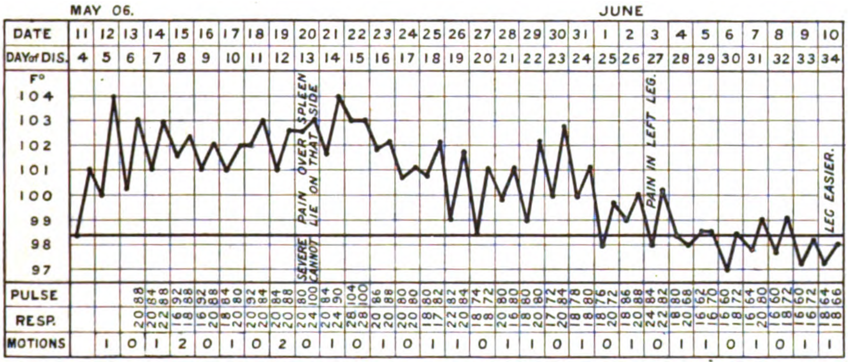
No pain except slight headache. No marked abdominal tenderness; slight in splenic area. Spleen just palpable. Occasional sibilant rhonchi in lungs. Ordered quinine sulph. gr. x. daily. 27th and 28th: Considerable diarrhœa of a thin yellow nature. Starch and opium enema given, since when diarrhœa has been checked. Fever has varied from 101° to 103° F. during the week he has been in hospital. 29th: He was ordered a mustard leaf to chest, as bronchitis was greater. Seen in consultation with Major Edye, R.A.M.C., yesterday and diagnosed enteric fever. Tongue slightly tremulous and furred. Taken off soda water; albumen water substituted for it. This morning temperature shows a tendency to fall, being 100·2° F. only. Respirations 28, easy; pulse 88, good volume and tension. December 1st: No alteration, condition fair. 2nd: Had sore throat; gargle, pot. chlor., ordered. 3rd: Feels rather better this morning, but no marked alteration in physical condition. 4th: Slight epistaxis last night; throat still injected and relaxed. 5th: Better; temperature normal; states that but for his throat he feels quite well, and is hungry. 6th: Temperature 99·8° F.; tongue cleaning; respirations 20, pulse 72. 8th: Temperature, normal; doing satisfactorily in all respects. 9th: Temperature, last night 99·6° F. after enema; this morning normal, feels well. 10th: Satisfactory; temperature, normal; respirations 18, pulse, 56.

From this date he made an uninterrupted recovery (*vide* chart).

Medical Case Sheet.

History of Case of No. 54, *Private R., aged* 20.—Admitted to Section Hospital on May 13th, 1906, with a history of having been ill since May 9th, 1906, with giddiness, weakness, headache, and pain just below spleen. Detained on May 11th, 1906. Temperature normal. Given castor oil, b. o., four times. Evening temperature, 101° F.; diet, milk and soda. On admission he did not look ill, but he complained of headache, and tongue was coated slightly. No epistaxis nor distension of abdomen and no spots; lungs and heart normal; spleen slightly enlarged; no abdominal discomfort or distension. Placed in observation ward for enteric. 14th: Abdomen slightly distended; ordered turpentine enema; temperature last night 103° F.; slept well. 15th: Complains of pain in back of neck. 16th: Is looking brighter this morning, says he feels well. 17th: Frontal headache, tongue coated, eyes look heavy. Diagnosed enteric. 19th: Slight abdominal distension, and a few suspicious rose spots; tongue cleaner, headache gone, sleeps well; spleen enlarged. It appears a much milder case than one would imagine from temperature chart 20th: Said to have "wandered in his mind" last night. This morning complains of severe pain over splenic area; the pain is of pleuritic type;

no friction rub detected, nothing but acute tenderness and enlargement of spleen can be detected. Temperature 102·4° F.; respirations 20, pulse 80; pain came on very suddenly, no rigor; he cannot lie on his back or left side; tongue coated; ordered mustard leaf and hot stupes, and given liq. opii. sed. 21st: Pain still very severe, increased on deep inspiration; no friction rub to be heard. 22nd: Says he feels well but for pain in his side, and he looks well considering the stage of disease (fifteenth day) and the range of temperature; pain in side less; ordered liq. opii. sed., ♏x., pot. brom., gr. x.; slept well. 23rd: Pain in side gone; he can lie



on his back or side, no pain on pressure; he looks and feels well, tongue clean; no headache; temperature 102° F., respirations 20, pulse 80; a few sibilant râles in left chest, and coarse crepitations just above spleen. 28th: Doing well; nothing to note; temperature still keeps up, though normal yesterday morning. June 2nd: Pain in left leg; bellad. and glycerine; raised on pillow and bandaged. 3rd: Temperature normal; leg easier; doing well. 7th: Temperature normal four days. 9th: Temperature rose to 99° F. last night, otherwise nothing to note. 14th: Temperature normal since last entry, doing well; is not very much pulled down.

SOME ORIGINAL OBSERVATIONS ON RESPIRATORY-PULSE CURVES AND VENOUS PULSE IN HEALTHY PEOPLE.

By Lieutenant-Colonel H. E. DEANE.
Royal Army Medical Corps (R.).

These observations are the outcome of a paper I presented at the Annual Congress of Preventive Medicine in 1905, and published in May and June, 1906, on the "Causation and Prevention of the Irritable Heart of Soldiers." In that paper I referred to the increase of pulse-rate after a recruit's gymnastics, both free gymnastics and apparatus work. I realised that I wanted a standard for a comparison, and looked for one in various text-books on physiology. I found none.

I collected many observations of both sexes after such games as hockey and football, and after gymnastic exercises of various kinds. The tracings given to illustrate this paper were taken, except when otherwise stated, from non-commissioned officers undergoing training at the Aldershot gymnasium, which I have been able to do by the courtesy and help of Colonel S. P. Rolt, Inspector of Gymnasia. The observations led to others, which appear important, and which, I think, show that the effect of respiration on the circulation is not yet settled; and the observations have an important bearing on the stress now being laid on deep-breathing and so-called breathing exercises during gymnastic work. For reference I give quotations from Schäfer's "Text-book of Physiology," dealing with the influence of respiration on the pulse.

"The frequency of the heart is increased by inspiration by a lessening of the vagal tone."

"Diastole of heart favoured by inspiration."

"Systole of heart favoured by expiration."

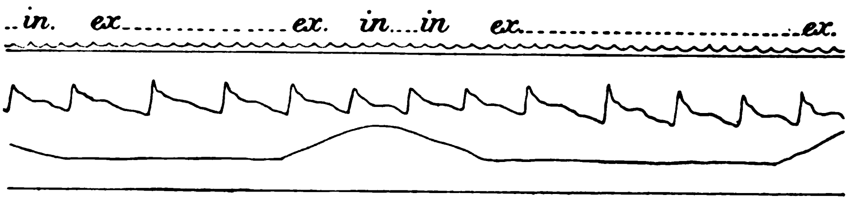
"Frequency of heart increased by inspiration."

"Frequency of heart lessened by expiration."

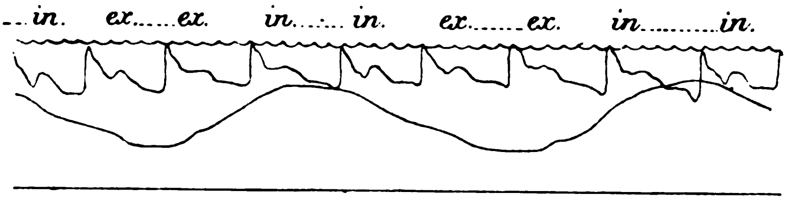
I have taken many simultaneous records of respiratory and pulse curves during the last two years, by means of Mackenzie's polygraph, on people leading an ordinary quiet life, on athletes, on trained gymnasts, and men undergoing gymnastic training, and on professionals, and I take for consideration, first, natural quiet respiration, giving samples of the tracings.

Quiet Respiration.—The quickening of the pulse during inspira-

tion and slowing during expiration, as laid down in the books, are not confined to the respective phases of the respiratory act. Take the slowing as a starting point. It does not always begin immediately on expiration, there being very often one or two beats the same length, or even shorter than the preceding inspiratory beat; then the expiratory diastoles lengthen, sometimes progressively to the end of expiration, though at other times the last expiratory diastole is shorter than the preceding ones.



TRACING NO. 1.



TRACING NO. 2.

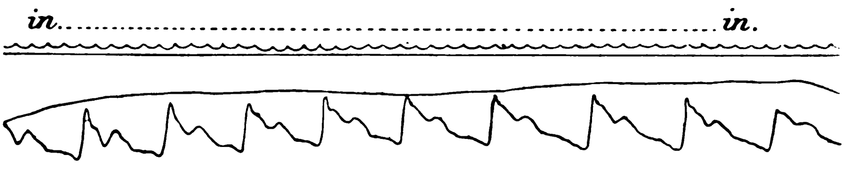
Sometimes, when marked slowing has begun suddenly on expiration, the succeeding diastoles become progressively shorter during the expiration and the following inspiration, and then the diastoles lengthen again (Tracing 1). Sometimes the first diastole of an inspiration is more prolonged than the preceding expiratory one (Tracing 2), as though the influence causing the lengthening were continued into the next inspiration.

Men in the best physical condition for effort and endurance, as George Hackenschmidt, the champion wrestler of the world, Tom Burrows, the champion club swinger of the world, whose tracings I have, show, in some cases, very slight respiratory pulse variations, in others the changes are very marked. Unfortunately, the length of the tracings are inconvenient for insertion in a journal.

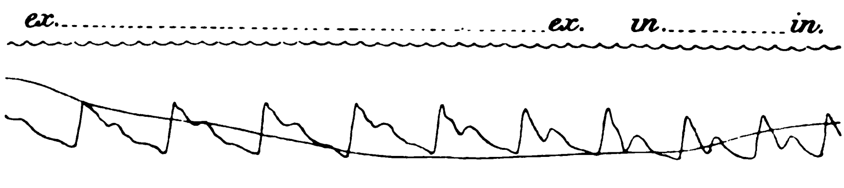
Deep Breathing.—Again, for reference, I quote from Schäfer's "Physiology": "The respiration is deep, the inspiratory movement is

executed more rapidly than the expiratory, and the periodicity is such that several heart-beats occur during each complete act of respiration. The heart-beat increases in frequency during inspiration."

I must first of all say that the deep breaths recorded on these tracings were drawn easily without any straining or effort whatever, nor was the breath held at all. I gave no directions except that no part of the body was to be moved in the slighest degree beyond the parts concerned in the breathing. The tracings were taken with the men sitting easily, and the arm to which the polygraph was attached on a level with the heart as near as possible.



TRACING No. 3.

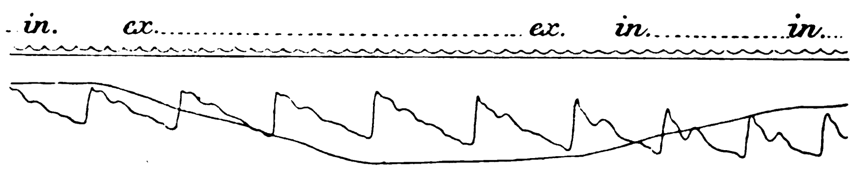


TRACING No. 4.

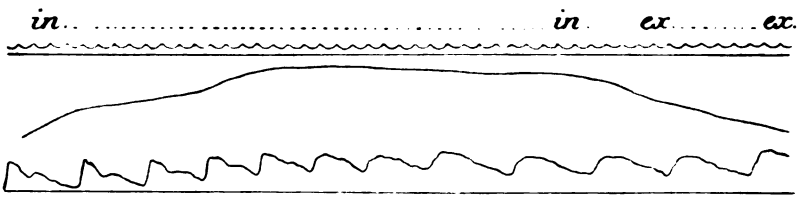
Until quite lately I had found some peculiar effects on the pulses during deep breathing only in men undergoing gymnastic training, but I have recently observed the same things in a youth of 17, at Charterhouse School, where there is no organised physical training apart from games. In this case the diastoles at the end of inspiration are much prolonged, the first inspiratory diastoles being equal to the preceding expiratory one; then follow two or three shortened ones, to be followed by the above-mentioned lengthened ones, which are continued into the following expiration, though not maintained throughout the expiration, quickening again beginning before inspiration sets in (Tracings 3, 4). This is not invariable, at times the lengthening persisting through expiration

(Tracing 5). During some inspirations the pulse becomes markedly dicrotic. At other times the upstroke of the tidal wave is much shortened and presents a flattened plateau, the whole tidal wave being sometimes represented simply by a curve, and this curve may be continued into the succeeding expiration (Tracing 6).

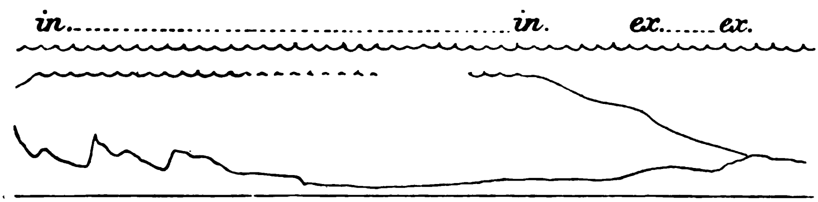
A frequent occurrence is complete stoppage of the pulse on deep inspiration. This occurs without any previous marked diastolic lengthening, and there are three or four beats of diminishing



TRACING NO. 5.



TRACING NO. 6



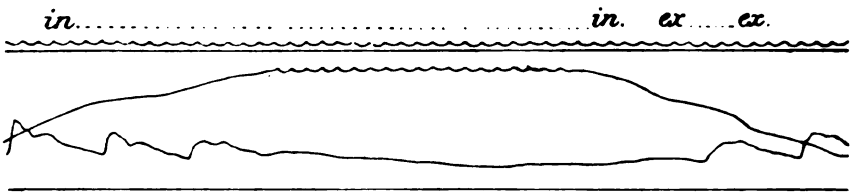
TRACING NO. 7.

amplitude before the stoppage occurs. The stoppage may continue into the succeeding expiration, and the return to normal is more or less sudden and complete, one, or perhaps two, diminished beats occurring before the return of the full pulse (Tracings 7, 8).

A quickening of the pulse at the beginning of a deep inspiration and a marked slowing towards the end, which slowing continues into the following expiration, then a gradual quickening again before

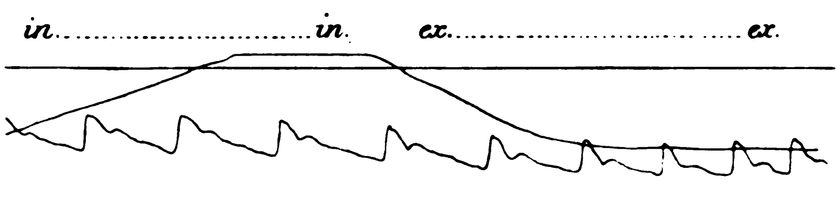
the expiration is completed, is a very common thing. The following tracings are samples (Tracings 9, 10, 11).

Sometimes the greatest diastolic lengthening occurs in the middle of the deep inspiration, the quickening occurring during the early part of the following expiration, then lengthening out again in the latter part of the expiration (Tracings 12, 13). The same man presented the same respiratory diastolic lengthening when he made



TRACING NO. 8.

TRACING NO. 9.

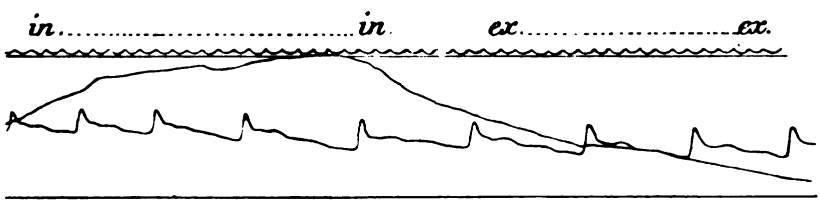


TRACING NO. 10.

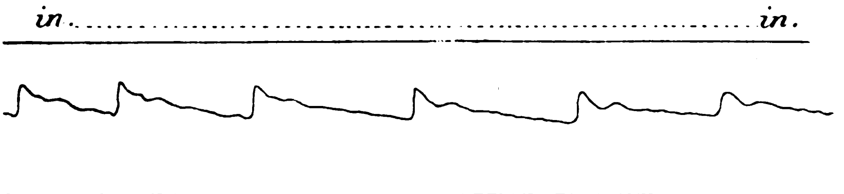
deep, quick inspirations and prolonged expirations, the expiratory diastoles diminishing, the first following inspiratory one being still smaller, to be followed by a greatly lengthened one (Tracing 14).

In one man in whom a stoppage of the pulse occurred during a deep inspiration, which was continued into the next expiration, a stoppage occurred during a few natural quiet inspirations following the deep one, and on continuing quiet respiration the pulse resumed its usual characters.

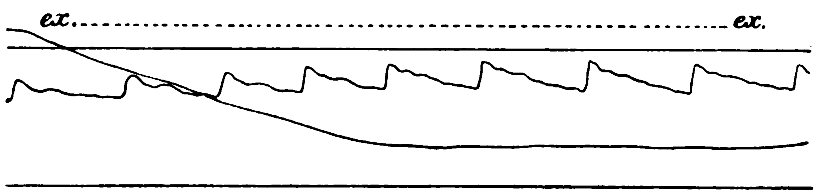
I have found this pulsus paradoxus common in soldiers undergoing training for gymnastic instructors, but, with the exception of the youth mentioned earlier in this paper, I have not yet met with it otherwise, but I have not yet made observations on a sufficient number of professionals to say what happens in their case. As graphic records will be worth more than mere description I give



TRACING No. 11.



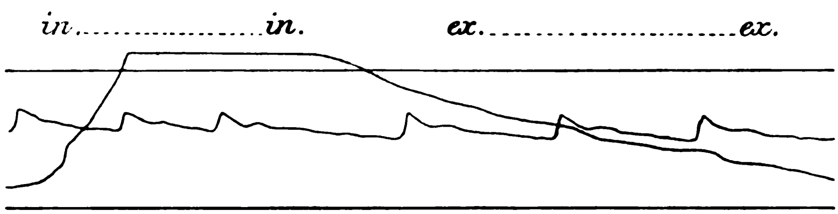
TRACING No. 12.



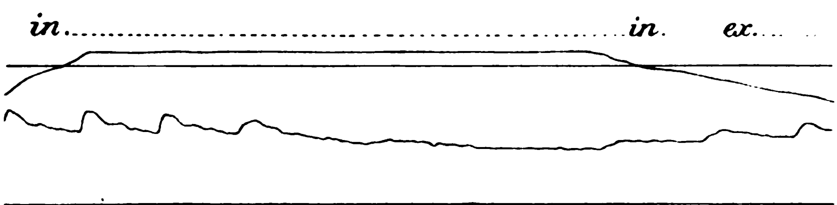
TRACING No. 13.

a selection of my tracings (Tracings 15, 16, 17, 18). There is a point requiring further observation and which I shall investigate as opportunity occurs, and that is, the effect of posture. In the case of a man who almost constantly presented a pulsus paradoxus on deep breathing, I was unable to obtain it when he was lying down on the few occasions on which I tried, but it did occur in the standing position.

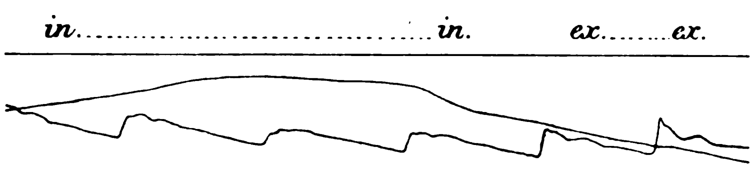
Referring to the quotations given previously from Schäfer's "Physiology" as to inspiration favouring diastole, does not that mean that the pulse would slow if inspiration were prolonged? If so, why is it said that inspiration quickens the pulse? Again, if the inspiratory quickening and expiratory slowing are due to vagal influence, why is the action reversed during deep breathing? It



TRACING No. 14.



TRACING No. 15.

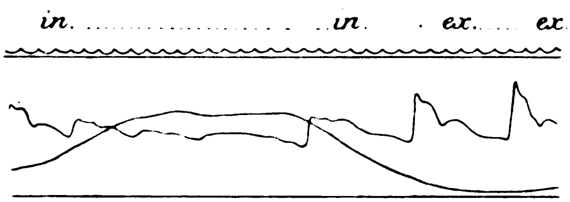


TRACING No. 16.

seems to me that these respiratory changes in the pulse may be due to varying quantities of blood in the heart, and that, if directly due to mechanical influence, such influence when started is continued for a time more or less irrespective of individual respiratory phases.

During the stoppage of the pulse the heart is beating regularly, but I am unable to give any graphic records of the fact. I have auscultated the heart with my finger on the pulse during the deep

inspiration, and beyond the sounds being somewhat muffled by the expanding lung, I could find no change in the heart's action, which was not at all rapid nor markedly slowed. None of the many cases which I have observed showed any change in appearance, nor experienced any change of sensation, in fact, were perfectly unconscious of anything happening. The references in literature to the pulsus paradoxus are practically confined to morbid states or adherent



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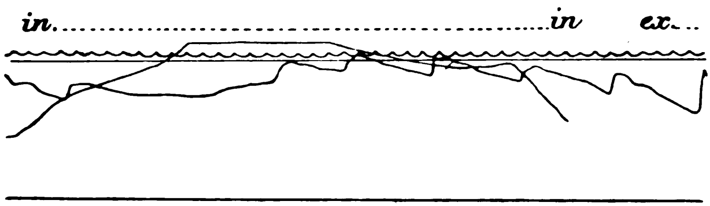

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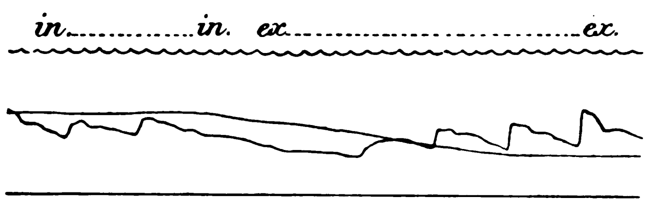
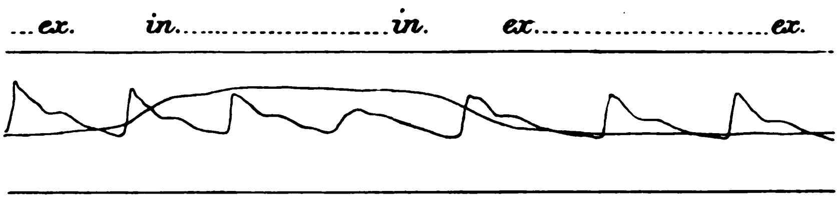


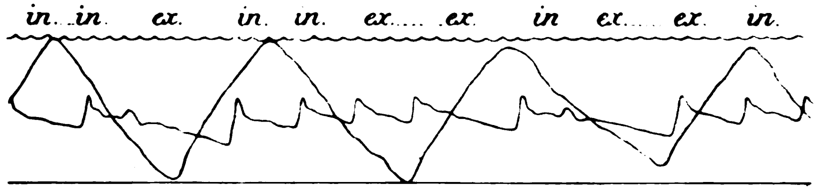
TRACING No. 19.

mediastinitis, the only exception I have met with being a tracing in Mackenzie's book on the pulse taken from a healthy man, and which he says he was unable to explain. The fact of the pulse stopping at the wrist, and of the heart-beats still continuing during that time, shows that not enough blood is being discharged from the left ventricle to reach the radial artery. What has happened to prevent it? The most feasible explanation is that the blood is being soaked up, as it were, by the lungs, and is not escaping

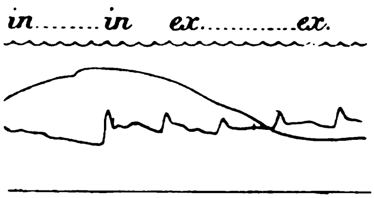
therefrom to the left side of the heart. Yet we see it stated in books that deep breathing assists the circulation of the blood from the right side of the heart to the lungs, through the lungs, and on to the left side of the heart. Is this stoppage of the pulse during a deep inspiration assisting the circulation, continuing as it does often into the following expiration? Deep breathing interspersed between exercises is supposed to quiet and equalise the circulation.



Tracing No. 20.



Tracing No. 21.

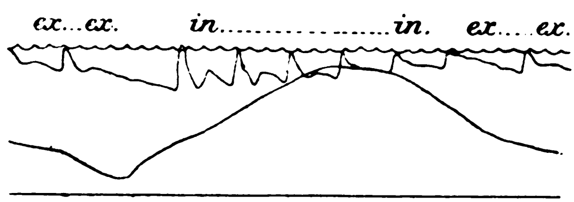


Tracing No. 22.

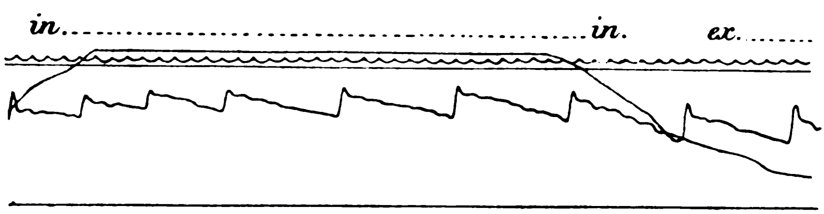
My observations tend to show the opposite. During deep breathing the respiratory rhythm is altered, inspiration being longer than expiration, and I am aware of no circumstances under which natural reflex breathing, so to speak, presents that character; a long, slow breath is an artificial proceeding performed by volition, whereas, when Nature requires a deeper breath it is drawn quickly, more in the nature of a long gasp, and, moreover, is not repeated immediately. So far as my observations have gone at present I am

forced to the conclusion that deep breathing between exercises as advised and practised is unnecessary for any beneficial effect on the circulation, and that it upsets the circulatory equilibrium with no obvious purpose. This leads me to the next series of observations I have made on the respiratory-pulse curves after the pulse has been quickened by such active exercise as running, both in untrained subjects and athletes.

After Quickening by Running.—During the panting period immediately succeeding the running the respiratory changes in the pulse are less marked; but as the respirations settle down, the



TRACING No. 23.



TRACING No. 24.

shortening during inspiration and lengthening during expiration becomes more marked. When the breath is sufficiently recovered to enable deeper breaths to be drawn there may be no appreciable effect on the pulse.

Space does not admit of sufficient lengths of the tracings to be shown, but one or two examples of a special kind are given. An officer in the gymnastic class showed a pulsus paradoxus when drawing deep breaths after a run, at one time the stoppage occurring at the end of inspiration and continuing for about the first half of the following expiration (Tracing 19). This disturbance is shown in a less degree in Tracing 20, a case of a medical student, in which the alteration of inspiratory beats is marked when

breathing deep after a run. During natural breathing no such change occurred. Sometimes the diastolic lengthening during the natural panting breathing after a run is very marked, as in Tracing 21, in which it occurs during expiration and attended by an extra systole. This only occurred in the part of the tracing taken immediately after the run. During deeper breathing after running much prolonged diastoles may occur during inspiration or expiration, as in Tracings 22 and 23 from the same man. When deeper breaths can be drawn after a run a prolonged diastole may occur during either inspiration or expiration, in either case the following beats being more rapid. Again, when breathing more deeply after a run, which in this case was not fast (Tracing 24), marked diastolic lengthening occurs after a shortening during inspiration, the lengthening becoming gradually less in the following expiration; when the natural breathing was not interfered with diastolic lengthening took place during expirations.

All these tracings were taken in the sitting posture, and the men were taken from their gymnastic classes, and the tendency of the deep breaths drawn was to increase the pulse rate, in addition to altering the rhythm. If a man's pulse is very much quickened by exercise the easiest and quickest way to slow it down is to rest the man in either a sitting or lying position.

These observations seem to show that the subject of the effect of respiration on the pulse requires further investigation, and that explanations given of the pulsus paradoxus require modifying, in the light of the illustrations I have given having occurred in strong, healthy men.

(*To be continued*).

ENTERIC FEVER—IS IT INVARIABLY A WATER-BORNE DISEASE?

By Surgeon-General RICHARD H. QUILL.
Army Medical Staff.

In my article under the above heading which appeared in the September (1906) number of our Journal, I hoped I had shown good reason for the belief that no reasonable connection could be traced between the water supply and the epidemic of enteric fever which, in 1900, broke out among the Boer prisoners of war incarcerated at Diyatalawa Camp, Ceylon. In so far as Major Norman Faichnie is concerned, my hope, I regret to say, has not been realised. That officer, in his article published in the March number of our Journal for 1907, still hugs the opinion that an impure water supply was responsible for the epidemic referred to. Major Faichnie is so confirmed a "water bigot," that I feel any further attempt to convert him to my belief of the origin of the "Diyatalawa epidemic" would be fruitless. I propose, therefore, here to do little more than correct some cardinal errors which I find in his recent contribution to the subject at issue.

On the faith of certain information collected from Ceylon correspondents, Major Faichnie throws considerable doubt on the accuracy of statements made in my previous article on the source of the water supply for Diyatalawa Camp. I can only adhere to my original statement, and in its support quote as follows from the "Medical Report on the Prisoners of War in Ceylon, for the year ending August 10th, 1901," addressed to the Colonial Secretary, Ceylon, by Sir Allan Perry, the Principal Civil Medical Officer.

"*Water Supply of Diyatalawa Camp.*—The water supply of the camp was derived from two sources on the adjoining mountain range, viz., the springs of Roehampton and Kahagala. The Kahagala source furnished all the water for the camp *for a brief period*, the Roehampton supply, a little later, was used concurrently with the Kahagala supply *until October 26th*, 1900, on which date the Kahagala supply *was held in reserve*, and the Roehampton Spring *exclusively used*, an arrangement which has continued up to date, *i.e.*, August 10th, 1901."

I draw special attention to some points in connection with the foregoing official statement.

Major Faichnie, as the result of his Ceylon enquiries, lays great

stress on his belief "that an impure water supplied the Diyatalawa Camp for most of the time the Boer prisoners of war were in occupation, and that the epidemic of enteric fever which occurred among them was the direct consequence of that impure water supply." Now what are the facts?

Assuming for the moment that the Kahagala source (the mis-named Hapartall source in Major Faichnie's article) was impure, such impurity could not have been responsible for the intensity and prolongation of the enteric fever epidemic which attacked the Diyatalawa Camp. Why? *Because the assumed impure supply was cut off on October 26th*, 1900, *i.e.*, at the very commencement of the epidemic, when only a few sporadic cases of fever were arresting attention. It was during November and December, 1900, that the epidemic was at its height, but during those and subsequent months the only water supplied to the camp came from the Roehampton Spring, an accepted pure source, and the one which at present supplies Diyatalawa Camp with drinking water. This statement of fact hardly fits in with Major Faichnie's belief: "that the great primary factor for the cessation of the epidemic under reference was the cutting off of a supply of impure water." Unfortunately for such a belief, I have, I think, conclusively shown *that the assumed impure supply was cut off before the epidemic had commenced, and that an admitted pure water supply was in use while the epidemic was at its height.* Further, as a matter of fact, the Kahagala source, so far as my recollection goes, was not cut off on account of a suspected impurity, but simply because it was not required, the Roehampton supply being in itself sufficient. I need only mention the fact that the Kahagala source was held *as a "reserve supply"* to disprove the view that any suspicion of its impurity was entertained. Before I leave this "Kahagala source," the alleged impurity of which is the "hole in my armour" which Major Faichnie believes he has found, I should like to say that the water from that source did not pass through the iron pipes which conveyed to camp the Roehampton supply. I mention this to prevent the surmise that the pipes conveying the pure Roehampton supply were, in the first instance, fouled by the alleged impure Kahagala supply.

As to the Roehampton source which supplied the camp with water from October 26th, 1900, up to date, I do not gather from Major Faichnie's article that he impeaches that source as impure. The dangers, if any, which threatened that supply during the period the Boer prisoners of war occupied the Diyatalawa Camp exist

still, yet we do not find that enteric fever in epidemic form has re-appeared. Indeed, it is not conceivable that the sanitary authorities at Diyatalawa would permit the use of a water of suspicious purity, therefore I feel justified in assuming that the Roehampton supply satisfies Major Faichnie.

With regard to the proximity of tea estates to a water supply; undoubtedly such proximity is undesirable, but before excretal impurities on an estate can be convicted, during the rainy season, of starting an epidemic of enteric fever by fouling a neighbouring water supply, we must prove that the fouling material contains the contagium of enteric fever. In that connection it is to be recorded that the Principal Civil Medical Officer of Ceylon (I quote from his official report) did not neglect to make careful enquiry as to the existence of enteric fever in the villages and tea estates in the neighbourhood of the Diyatalawa Camp. No fever approaching the enteric type was found to exist among the estate coolies; and further, it is well known that enteric fever rarely if ever attacks the Malabar coolies who form the bulk of a tea estate population. The foregoing investigation is a further check to the theory of Major Faichnie.

I do not think I need make any further observations in refutation of the doubt which Major Faichnie has seen fit to throw on the belief of those who had to fight a formidable epidemic of enteric fever, and who spent many laborious hours in investigating its origin, and in rebutting its presence. Inasmuch as the brunt of the epidemic fell upon the Boer prisoners of war, the main portion of the work in connection with that epidemic fell upon Sir Allan Perry, Principal Civil Medical Officer in Ceylon, and his very able Assistant, Dr. Garvin, of the Ceylon Medical Service, who was in medical charge of the prisoners' camp; should this article come to be read by either of those gentlemen I hope they will join with me in repudiating the views of a critic so intoxicated with the water-borne origin of enteric fever that he can admit no other possible existing cause.

A PLEA FOR A MORE RADICAL TREATMENT OF ENLARGED TONSILS, VIZ., FREE EXCISION, WITH RATIONAL AFTER TREATMENT.

By Major G. A. MOORE.
Royal Army Medical Corps.

In the Corps Journal of February, 1905, Major R. F. Austin, R.A.M.C., dealt with a subject of the greatest importance to all medical officers, viz., the treatment of otorrhœa and middle ear disease in the Army. In this article he pleaded for a more systematic and radical line of treatment than is usually accorded to such cases, outlined his scheme of attendance and regular medical supervision, and showed that by the adoption of such, benefit would result to the patient, and valuable time of trained soldiers be saved to the State.

I am prompted by the above to bring forward some remarks on another somewhat kindred affection, which accounts annually for hundreds of days spent in our hospitals at home and abroad, viz., chronic hypertrophy of tonsils.

Let any of us stationed at depôts or serving with young line regiments look over the medical history sheets of 100 young soldiers, on completion of, let us say, eighteen months' service. He will find that from 10 to 15 per cent. have been treated at hospital for "sore throat" of some form, that five to fifteen days have been spent there, and that the sore throat in 95 per cent. of cases could be classed under one of the following heads: (*a*) lacunar tonsillitis (usually called follicular); (*b*) peri-tonsillitis; (*c*) interstitial tonsillitis (quinsy); (*d*) ulcerative tonsillitis (rarest kind).

I do not propose to take up space by discussing in detail the features, or treatment of, these varieties. These can be referred to, if necessary, in any good work on diseases of the throat. After some three to eight days' appropriate treatment, whatever variety of tonsillar affection has been present, the symptoms will almost certainly have subsided. It is as to the wisest procedure to be adopted at this stage that I wish to draw attention.

Two courses are open. The first is to keep the patient in hospital on generous diet and tonics, before sending him back to his duty; being fully aware that within a year at most, in a large class of cases (to which I shall presently allude), he will come again under treatment for a similar attack, or rather for what is more

probable, a more serious form of the affection. The reason for this is, that the tonsil after each attack becomes more fibrous, more enlarged, and less resistant to irritating and septic influences. And so the cycle goes on, winter after winter, cold, sore throat, tonsillitis with its pain and constitutional disturbances to the man, and the deprivation of ten to fifteen days' service to the State during his enforced stay in hospital.

The second course, and I feel sure the right one, is very simple: free excision of one or both tonsils. It is fairest, perhaps, to consider this from the point of view of those most concerned.

(1) For the patient, the operation will be of the greatest benefit: he will be done for ever with the painful tonsillar attacks, his respiration becomes easier, doubling, drills, gymnastics, before demanding considerable exertion, will be rendered less difficult, and his appetite, sleep, spirits, and general health will all greatly improve. (2) For the State the man will be a better bargain. Instead of some five to fifteen days in hospital, say every second year (a low estimate), he in all probability not only will not suffer with his throat, and be compelled to give up his work, but the relief and stimulus given to his whole system will render temporary breakdowns from other affections less likely. As a consequence, in his three to nine years service less of his time will be spent away from his legitimate duties.

Cases suitable for tonsillotomy: (*a*) Where the tonsils are much enlarged, projecting beyond the anterior pillars and perhaps (one or both) touching the uvula; (*b*) where the patient comes to hospital for a severe tonsillar attack, *e.g.*, quinsy, lacunar tonsillitis, and volunteers the fact that winter after winter he has so suffered, and where the condition under (*a*) co-exists; (*c*) where in addition to (*a*) there exists nasal voice, obvious nasal obstruction, and evidence of old or still existing post-nasal growths with their consequences—high arched palate, projecting upper teeth, pallid face, deafness, vacant appearance, and general look of ill-aerated blood; (*d*) when co-existent or not with condition (*a*), on stripping the patient, and studying the respiratory movements, signs of the evil consequences of the action of the extraordinary muscles of inspiration on immature structures are apparent—pigeon breast, tendency to hernia, &c.

Operation.—In a considerable number of cases recently treated by free excision of one or both tonsils, I have never thought it necessary to give an anæsthetic, local or general. I would not, however, be dogmatic on this point, and dealing with patients

of certain temperaments, some local application of menthol or cocaine, or even a general anæsthetic, might render the proceeding more practicable for the operator.

The chief points, perhaps, before tonsillotomy, are to be certain the tonsil and its surroundings are no longer tender, and that all constitutional disturbance has entirely subsided. The actual proceeding of removal of tonsils is very simple. The patient sits facing the light. I sit opposite him. Holding the guillotine in my left hand, I sink the first two fingers of my right hand under his left jaw, and press the tonsil inwards. Next, with a light shaking movement, I get the tonsil into the guillotine and remove it. I then change the instrument into the right hand, and placing my left hand under the right lower jaw, remove the other tonsil. All this should not take more than ten to fifteen seconds. The left tonsil is rather the harder of the two to remove neatly, and should be done first. As to the instruments, opinions vary greatly. I used to prefer guillotines with a fork; now I use Charles Heath's, in which the handle is set at right angles to the gliding blade. It is an excellent instrument, is made in three sizes, one handle fitting all the blades. Should the patient refuse the guillotine, the cautery or wire ecraseur may be used. If the tonsils are very large, but flat and non-bulging, treatment is equally imperative but rather more difficult. In such cases Tilley's tonsil punch gives the best results. Slow removal of the tonsillar substance by wires, ecraseurs and snares, is tedious and painful.

Two days before removal of tonsils, the patient should be placed on milk diet, and a course of instruction in breathing exercises commenced, with a view to teaching him to inspire through his nose, warm, filtered and moistened air, as Nature intended him to do, instead of cold, dust-laden, dry air straight into the lungs by way of the mouth, which, up to date, most probably has been his habit.

After the operation he is kept in bed for forty-eight hours in a ward at a temperature of 65° F. Cocoa, tea, milk, eggs, bread sop, whey and lemonade are allowed, all to be taken cold. A large pad of wool is placed under each lower jaw, and kept there by a flannel bandage passed over the head. This serves to keep the mouth closed, and induces him to nose-breathe. After forty-eight hours the cut surfaces are swabbed twice daily with glycerine and carbolic. Inhalations, tincture benz. co. or of creosote, are given for the first two nights. On the third day he is allowed up, given very generous diet, and further instructed in proper chest expansion and nose breathing. A course of tonics is prescribed, the elements of hygiene,

cleanliness and ventilation are instilled into him, and he goes back to his full duties seven days at the latest after the operation.

The only danger of tonsillotomy is that of hæmorrhage. The risk of this cannot be ignored. Dr. C. Jackson states he has had to ligature the carotid in six cases. Fatal cases have occurred in all countries. Gargling with very hot water, alternating with iced water, iced compresses under the jaws, free exposure of the mouth and throat at an open window, with frequent inspirations through the mouth, the lying down position: all are useful in arresting hæmorrhage if venous in origin. Excluding hæmophilic patients, venous hæmorrhage is most likely to be met with in patients over 25 years of age who have suffered from recurrent attacks of tonsillar inflammation, and in whom the adenoid structures have been largely replaced by fibrous connective tissue, which, containing but little elasticity, is powerless to contract the divided venous channels.

At Golden Square the staff are very chary of removing tonsils in patients over 25 years of age by the guillotine. As a rule in such cases they prefer the use of the cautery, or, if imperative, enucleation under a general anæsthetic.

If the hæmorrhage be arterial, matters are very different. One is recommended to grasp the bleeding point—excellent advice, but difficult of execution. The best plan is to at once apply firm pressure locally. I use large forceps (like a tongue forceps), the fenestrated blades of which have attached to them pads of plain gauze. One of these soaked in turpentine is pressed over the site of the hæmorrhage, while the other blade is fixed under the jaw outside, and the instrument clamped. Pressure can be left on by this means for a quarter of an hour at a time if necessary. I had one very bad case of hæmorrhage. In this I tried digital compression, but met with difficulty and poor result; luckily, however, the patient fainted, a process I invited by closing all the windows in a small room, and keeping him standing by a very hot fire: when the heart's action became feeble the bleeding stopped. The great difficulty in such cases is to retain the patient's fullest confidence. With his mouth full of blood not unnaturally he is frightened, and may not allow either finger or instrument into his mouth. Among cases where one might be on their guard for arterial hæmorrhage are those in patients over 28 years of age, whose tonsils are very large and projecting, and attached to their bases only by a thin pedicle, containing probably but one arterial branch.

In the series of cases under notice I have freely removed tonsils in men over 25 years of age, but always at their own request. I

hold the opinion, however, that if every precaution is taken, and appliances kept ready, no healthy man should be denied the certain benefit of operation by an undue fear of possible hæmorrhage.

Sequelæ.—These should be rare. In my cases I have met with the following :—

(1) *Acute Laryngitis.*—This occurred four days after the operation (in a case where the tonsils removed had been unusually large and both touched the uvula). I can only ascribe it to direct chill, the cold air striking his voice-producing apparatus in a great and unaccustomed volume. The well-warmed ward and confinement to bed for forty-eight hours with the jaws bandaged up undoubtedly prevents my having to record larger numbers of this affection.

(2) *Peri-tonsillitis.*—(*a*) *Simple.* This condition reflects somewhat on the operator, as it, as a rule, must follow cases where the palate, uvula, or faucial pillars have been bruised or roughly handled during the operation. With care and increased experience it should rarely be present in any appreciable degree. (*b*) *Suppurative.* This must occur where the operation has been performed on suppurative tonsils, and where septic cut surfaces remain behind, or where infection has been conveyed to the freshly cut tonsils by imperfectly sterilised instruments.

(3) *Supra-tonsillar Abscess.*—In one of my cases this followed a very free excision, and must have been due to septic infection from the tonsils travelling up into the supra-tonsillar fossa. This I should have guarded against, and now do, by thoroughly exploring the supra-tonsillar region, and assuring myself that all inflammation has quite subsided. Gentle use of a probe will elicit this information.

Conclusion.—I can most strongly recommend, in all cases coming under the headings mentioned, the practice of free removal of tonsils, and the great value of impressing at the same time on the patients, or parents (in the case of children), the importance of using the nose as the sole channel for the inspired air. Twenty long quiet inspirations through the nose early morning, after lunch, and at bedtime practised for a few days will tend to create the habit, the good results of which will soon be evident to the patient and those round him. The more the nose is used the better it will carry out its functions. If one doubts this, let him look at the nose of a confirmed mouth-breather, and see his nostrils, narrow, small, and sluggish to dilate, and the general drawn and stupid expression of his face. I have seen lately many of these cases where, by the employment of simple breathing exercises, snuffling,

nasal obstructive symptoms, hay fever troubles, dry mouths, snoring, &c., have been, even in a few weeks, considerably lessened or entirely got rid of.

Synopsis of Cases.—Dealing chiefly with healthy young adults, 17 to 25 years of age, there is naturally a great sameness in my cases. Seven were of men over 30 years of age, and all were greatly benefited by free removal. Six were of men (with huge hypertrophied tonsils almost touching the uvula) who had recently contracted syphilis; with the prospect of some two years' treatment before them for this disease, and after explaining that considerable benefit would be derived, I readily obtained their consent to operation, and in all excellent results followed. In this class of case I hope to pursue this treatment energetically. In four cases the patients were unusually plethoric, and breathless on exertion; after free removal, and a course of breathing exercises, their respirations averaged three to five a minute fewer, and there was much less breathlessness.

Should adenoids be associated with enlarged tonsils to a marked degree, these must be removed at the same time, a general anæsthetic being given.

TABLE OF CASES ARRANGED IN CLASSES AS DESCRIBED.

Class	Number of cases	Years				
		Under 14	14 to 17	18 to 21	22 to 30	30 upwards
Class A.	45	5	1	31	5	3
,, B.	50	1	6	28	10	5
,, C.	16	—	4	10	2	—
,, D.	7	2	3	2	—	—
Miscellaneous. Removal of tonsils, adenoids and polypi	7	2	2	2	—	1
	125	10	16	73	17	9

Physiology tells us our lungs are entitled to a supply of inspired air under very definite conditions, viz., duly warmed, moistened and filtered, and that these are necessary for the proper interchange of gases. Air to fulfil all these requirements can be supplied by one channel only—the nose. Our noses are equipped with air-warming, air-filtering, air-moistening apparatus. Do, then, our lungs always receive such air? No. In many cases from various causes, ignorance of simple hygienic principles, working in constrained posi-

tions, &c., incorrect respiratory movements are picked up. The nose is used less and less, and the habit of mouth breathing is acquired. Cold, dry, dust and germ-laden air now reaches our lungs. Is it any wonder, then, that our pharynx, tonsils and fauces, in endeavouring to imitate the functions performed with ease by our nose, suffer in the attempt? Granted, then, "mcuth breathing" once established, dry mouth, catarrh, tonsillitis, irritable cough and bronchitis inevitably follow. Let us, then, as far as possible, minimise the likelihood of these affections arising both in our patients and our own persons by making it a rule to carry on inspiration—yes, and expiration also—through the nose alone. There is no great difficulty in so doing, and to anyone sceptical of the effects that will follow, I would only say "try it."

A STAFF RIDE.

By Major F. J. WADE-BROWN.
Royal Army Medical Corps.

Ordered again on a staff ride, I remember well how at one time such an order would fill me with trepidation and misery, but now, the result of experience, I feel that instead of being a subject for commiseration I ought really to be congratulated, and that I am preventing a less fortunate officer from obtaining an experience of inestimable value. I regret to say there are still many who feel as I first did, and it is to the uninitiated that these few remarks are addressed.

If such an one thinks he is going out simply to medically attend the other officers on the staff ride he has made a very great mistake, for he will find that he is to be the Principal Medical Officer of a large imaginary force, or the Administrative Medical Officer of a division, or he may be the Officer Commanding a Field Ambulance, or perhaps a Sanitary Officer. Units have to be moved, hospitals established, sanitary conditions of positions, bivouacs and camps reported upon, and sanitary reports on towns for billeting sent in. Ambulance trains, base hospitals, medical store depôts and hospital ships, all have to be arranged and worked in conformity with the requirements of a field force.

Shortly after receiving the order detailing one for a staff ride, or staff tour, as it is sometimes called, a paper is sent from the staff office of the district containing what is known as a "General Idea," and also a "Special Idea," a mixture of diagnosis and prognosis. It will also be noted that an "Appreciation" has to be sent to the staff office by a certain date. Now, what is an "Appreciation"? An "Appreciation" is a description of the present situation and the forecasting of events. To other officers it means a consideration of the military features of the country in connection with the stated conditions, object, and how it can be carried out, what the enemy may do and what may be done to frustrate his plans, strength, artillery position, strategical flank, tactical flank, and so on. This has little or nothing to do with the medical officer, whose "Appreciation" should show the medical preparations made for war, and what may be expected during the campaign.

The following points may be considered: Strengths of both

armies (as worked out from War Establishments); medical *personnel* of all units; description of base hospitals and where established; depôts of medical stores; ambulance trains, with a short description of railway lines and stations suitable for entraining sick and wounded; hospital ships, where equipped, and ports of probable call; consultation held with subordinate medical officers, communicating special instructions received from the Director-General, instructions for keeping accurate returns, and other points contained in the Regulations for Army Medical Services; hospitals in reserve (stationary and general hospitals) and convalescent camps; dealings with aid societies; parts of the Geneva Convention appertaining to the sick and wounded, ambulances and hospitals, as set forth in the "Laws and Customs of War"; and finally, a general discussion on the probabilities of wounds and disease during the campaign, and how the latter can be avoided or met and dealt with.

A day or so before the staff ride commences a notice will be received, stating place of rendezvous, hour of arrival, and what hotel arrangements have been made.

Before leaving it is well to be provided with most or all of the following, which should be packed in a separate valise, so that they can be got at quickly, for time means everything on a staff ride, and you do not want to waste precious moments hunting for this or that: Ordnance maps (some will be sent from staff office), a large supply of foolscap paper and some blotting paper, compasses, coloured pencils, stylographic pen, paper clips or pins, A.B. 153 for orders, War Establishments, King's Regulations, Regulations for Army Medical Services, Combined Training, A.F.O. 1800 (six), and last, but not least, A.F.O. 1771. A little book, by Captain A. H. Marindin, of the Black Watch, called "Staff Rides," published by H. Rees, Limited, 119, Pall Mall, S.W., is worth purchasing. The chapter on "Reconnaissance" gives some most useful hints on preparing reports, and the following chapter on "Operation Orders" helps one out of many difficulties. Should an officer possess a bicycle he should take it with him; it will be sure to prove useful.

To give an idea of a staff ride, perhaps it would be well for me to describe, as briefly as possible, what happened to me on my last one. On Monday, March 11, of the present year, we assembled at the Stanhoe Hotel, Worthing, and at 6 p.m. our General Officer Commanding-in-Chief, Colonel F. Romilly, of the Scots Guards, held a conference; he explained the situation, and gave us his idea of operations. We were then told to write our orders for the

next day, and later on we received our instructions for the next day's work. I might here state that our army, the Blue Army, was composed of three divisions and a mounted brigade, nearly 60,000 men. The enemy, Red Army, had, in addition, a force of nearly 12,000 auxiliaries.

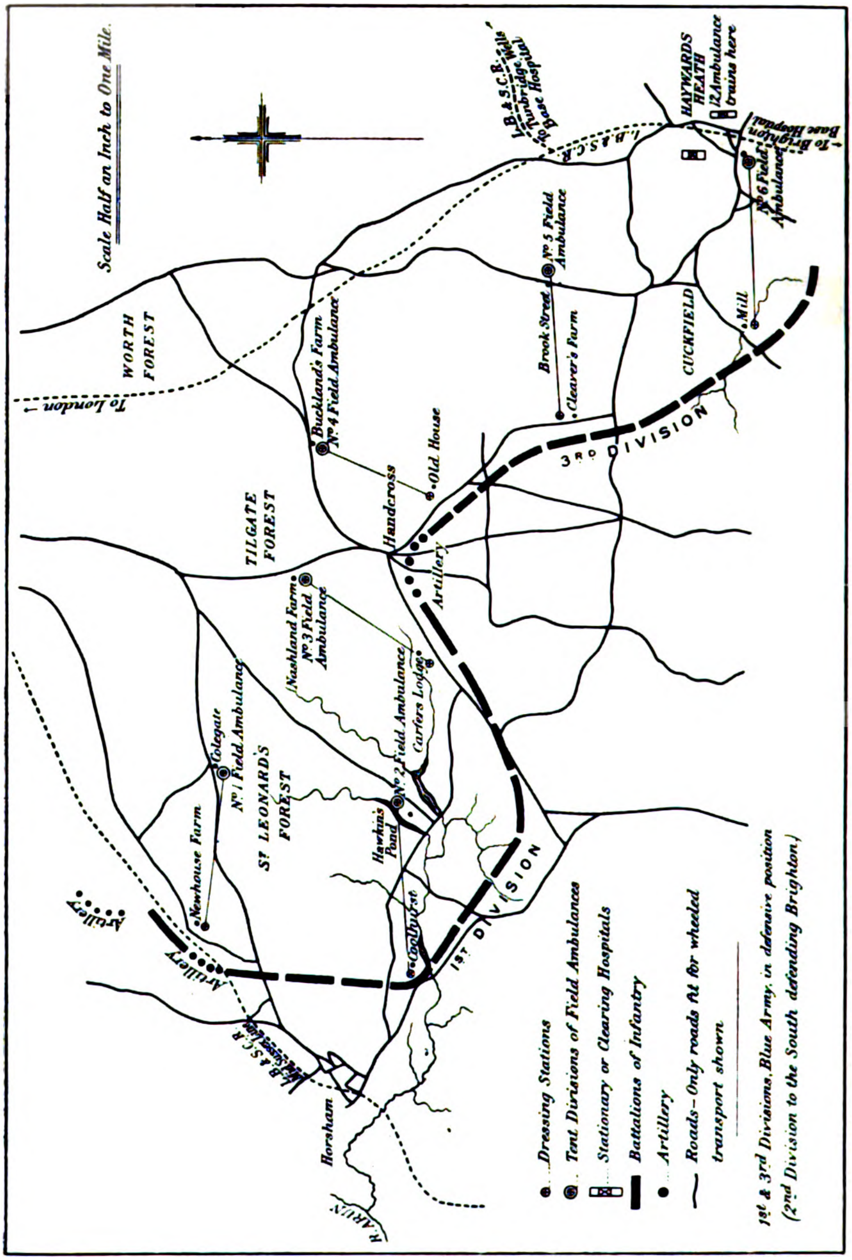
On the morning of the 12th I motored with the General Officer Commanding 2nd Division to Devil's Dyke and the hills near Brighton, made notes regarding the position selected by the General Officer Commanding, and drew a rough map of the surrounding country. On returning to the hotel at 3 p.m., I wrote a full report and handed it to the Staff Officer at 5 p.m. After this, orders were issued, a conference held, and instructions received for the next day's work.

On the 13th I accompanied the General Officer Commanding 1st Division to Horsham, who had selected a line of defence four miles west of that town. My orders were to report on the sanitary and hospital arrangements of the position, also bivouacs, encampments and water supply. In the evening we learnt that our mounted troops had met with a reverse, and that the 1st Division was to retire and join the 3rd Division from Tunbridge Wells, between Horsham and Hayward's Heath.

A big fight being expected, I received orders to proceed, on the 14th, to Hayward's Heath and make all arrangements for dealing with the sick and wounded. This certainly was what one might rightly call a "tall order"; it meant selecting sites for dressing stations and tent divisions of the field ambulances, finding roads for transport, establishing stationary or clearing hospitals at Hayward's Heath, and the ordering of ambulance trains—in fact, describing the medical organisation from fighting line to base. The orders and notifications that had to be sent were voluminous. During the evening we were told to send in a second "Appreciation," and were informed that General Sir Frederick Stopford, commanding the London District, would meet all officers at Arundel at 10.30 a.m. the following day.

The next morning a great conference took place at the Norfolk Hotel, Arundel, which lasted over two hours. The General, seated at the head of a long table, with the officers of the Blue Army on one side and those of the Red Army on the other, fully described the work of the previous four days; he commented on our shortcomings and congratulated us upon our well-doings.

We left Arundel about 4 o'clock, and arrived in London at 6 p.m.; our staff ride was over, and we all felt the need of a rest


Scale Half an Inch to One Mile.
WORTH FOREST
To London
L.B.&S.C.R.
To Tunbridge Wells Base Hospital
HAYWARDS HEATH
12 Ambulance trains here
To Brighton Base Hospital
Nº 6 Field Ambulance
Nº 5 Field Ambulance
Brook Street
Cleaver's Farm
CUCKFIELD
Mill
Bucklands Farm
Nº 4 Field Ambulance
Old House
3RD DIVISION
TILGATE FOREST
Handcross
Artillery
Nashland Farm
Nº 3 Field Ambulance
Nº 2 Field Ambulance
Carters Lodge
Colegate
Nº 1 Field Ambulance
ST LEONARD'S FOREST
Newhouse Farm
Hawkins Pond
Coolhurst
1ST DIVISION
Artillery
Artillery
Horsham
R. ARUN
Dressing Stations
Tent Divisions of Field Ambulances
Stationary or Clearing Hospitals
Battalions of Infantry
Artillery
Roads - Only roads fit for wheeled transport shown
1st & 3rd Divisions, Blue Army, in defensive position
(2nd Division to the South defending Brighton)

after so much hard work, which lasted each day from 9 a.m. till 11 p.m., or even later.

In conclusion, I have no hesitation in saying a staff ride is a wonderful education; it puts one's powers of organisation to a severe test; all we do is closely and carefully criticised; we get censured, we get praised, but we learn a lot, and what is more, we prove to other officers how important and indispensable our department is on active service. In proof of this, I might say that the senior officers do not hesitate to record that they read our reports with the greatest interest, and learn a great deal from them. Surely they could not be more eulogistic or pay us a better compliment, and in thanking them, I feel all officers who have attended staff rides will join with me in saying that, without their courtesy and kind co-operation, which at all times they are only too happy to afford us, our work would lose a great deal of its interest, and aid us but very little when called upon to face the reality. *Omne tulit punctum qui miscuit utile dulci.*

Clinical and other Notes.

AN INCINERATOR AS USED AT THE STATION HOSPITAL, WELLINGTON, INDIA, FOR DEALING WITH KITCHEN REFUSE AND NIGHT-SOIL.

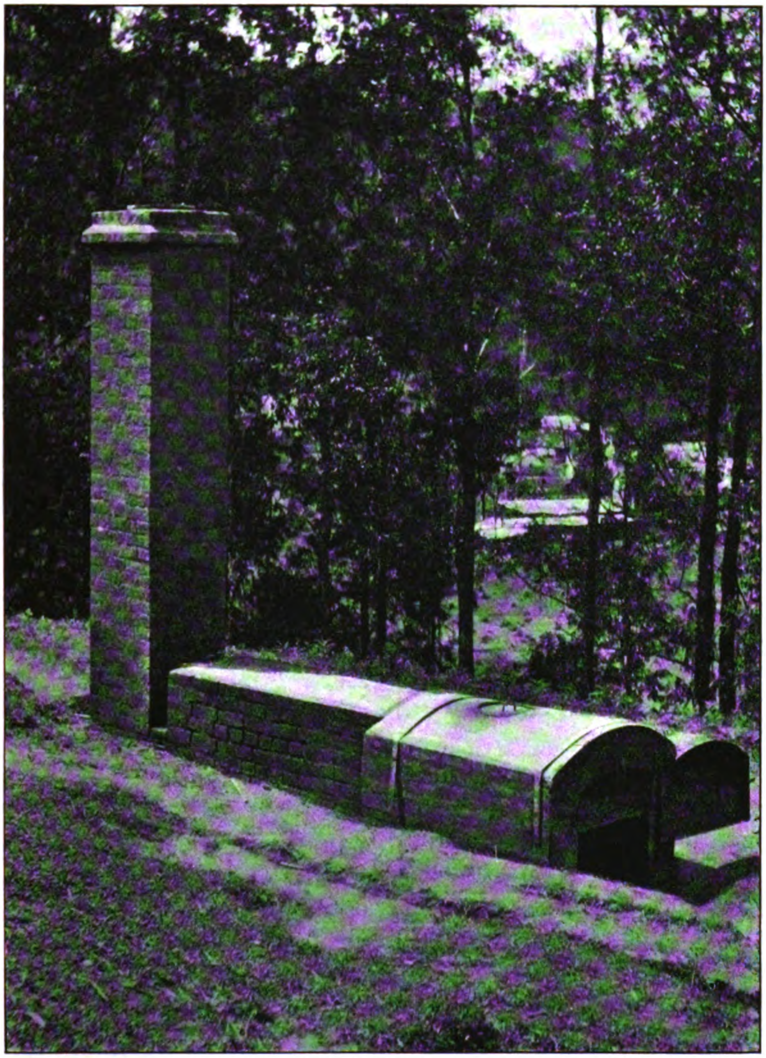
By Lieutenant-Colonel G. CREE.
Royal Army Medical Corps.

This incinerator is designed as follows: A grate, with the usual fire-bars and furnace door, which opens direct into the destruction chamber. This chamber is shaped as follows: In front it is the same width and height as the furnace, and the floor slopes from front to back to a depth of six inches, and the sides are gradually drawn together to the width of the flue at the back, and the roof is arched, so the whole chamber is roughly bottle-shaped. The floor is covered with an iron plate curved at the back to prevent a dead angle. In the front part of the roof is a circular opening covered in by an iron lid, through which the material for destruction is introduced. Just behind this is a baffle plate, the depth of which corresponds to the size of the flue opening. At the back of the destructor opening from its upper part is the flue. The flue leads at first in a horizontal direction for the greater part of its length and then makes a right angle bend downwards to the floor level, and again horizontally into the base of the chimney, this bend forming a combustion chamber for fumes and a trap for dust. The chimney is quite straight, with the exception of a small throat at the lower part.

The point aimed at in this apparatus is forced draught with its accompanying great heat, thereby ensuring a complete destruction of the materials, with also an absence of smell, smoke and dust.

The entire apparatus is, with the exception of the ironwork, built of masonry. In the one experimented with here it was built of ordinary unbaked bricks, but this material is not sufficiently strong to stand the great heat generated, and a permanent apparatus should be constructed of proper firebrick. The method of using it is as follows: The latrine pans and urine troughs are smeared with crude kerosine, and a small quantity of the same is poured over each motion by the sweeper. This has several advantages; it renders the soil more combustible, keeps flies away from it, and prevents the pans themselves from becoming soiled. The contents of the pan are, as usual, deposited in the usual iron receptacle till removed to the incinerator. The kitchen refuse is collected in the usual way, that is, the wet is separated from the dry, in separate utensils. In the morning the incinerator furnace is lit and in about half an hour, when the fire is burning freely and the apparatus is well heated, the rubbish and kitchen refuse is introduced, and when this is well dried

and beginning to burn the night-soil is introduced on the top of it. The contents of the incinerating chamber must be now occasionally turned over with the rake till the whole is destroyed.



An Incinerator at the Station Hospital, Wellington, India.

There are several points to carefully observe, and upon the observation of them the success of the process depends :—

(1) The stoking must be intelligently done, the fire must be burning

freely, and the apparatus well heated before the refuse is added; the fire must never be allowed to get low, the fuel being added in small quantities at short intervals, and not, as in the usual method, by the unintelligent, a large quantity of fuel at one time, so that the minimum of heat is produced and the maximum of smoke; the fire should always be burning freely and clearly, giving the maximum heat for the amount of fuel consumed. (2) The material for destruction must be added intelligently, that is, not too much at a time. (3) All openings, with the exception of the furnace door, must never be left open, as such a proceeding would abolish the forced draught on which the working of the apparatus depends. (4) The material in the destructor must be turned over at frequent intervals or it does not become dried as quickly as it should. When night-soil is being dealt with alone this is very marked.

The best fuel to use is, of course, coal, but wood works almost as well, if intelligently used. Here we have been using eucalyptus wood, which does not make a very hot flame, with complete success.

The cost of working has, so far, averaged 2 annas per hour for fuel, costing 4 annas the 100 lbs. If the cost of the crude oil is also added it comes to 11 annas an hour. Doubtless with more experience on the part of the sweepers in stoking a saving on this item could be effected, and also the greater number of hours the apparatus is being used would comparatively reduce the amount of fuel used each hour.

The apparatus designed here is considered large enough to deal with the refuse and excrement of half a battalion of infantry.

HYDROTHERAPY AS A FACTOR IN THE TREATMENT OF ACUTE CROUPOUS PNEUMONIA.

By Major C. W. R. HEALEY.
Royal Army Medical Corps.

In laying stress on a special line of treatment for acute croupous pneumonia, the most widespread and fatal of all acute diseases, according to Osler "killing more than diphtheria, and outranking even consumption as a cause of death," I am conscious of the fact that this treatment is not a new one; it is referred to in all modern books on medicine and therapeutics, but to my mind they do not lay sufficient stress on it, and none go into detail sufficiently to enable a person unacquainted with this treatment to carry out the procedure in a manner which will act with most benefit to the patient, and if not properly carried out the treatment is practically useless.

In looking up the Army Medical Reports for the years 1899 to 1904, I find that the total admissions and deaths from pneumonia in the Army in the United Kingdom are as follows:—

Year	Admissions	Deaths	Percentage of deaths	Total deaths from all respiratory diseases
1899	538	76	14·1	98
1900	1,268	300	23·6	372
1901	673	100	14·8	144
1902	627	86	13·7	115
1903	442	67	15·1	88
1904	416	47	11·2	59

We have only to peruse these figures to see how very fatal acute croupous pneumonia is and how many deaths occur in the Army at home annually from it, and also what a very large proportion of the total deaths from all respiratory diseases are due to pneumonia. During the years 1899 to 1904 (inclusive) there were, taking an average for the six years, 112 deaths annually from pneumonia; 15·4 per cent. of all admissions were fatal. This is not an exceptionally high percentage of deaths, as the ordinary civil hospitals' records vary from 20 to 40 per cent.; the latter hospitals, however, receive more aged patients than are met with in military hospitals; they also do not as a rule have their cases under treatment as early as is the case in military hospitals. These two last factors have an immense influence on the mortality, the disease being extremely fatal in old age and in those who have neglected to lie up at the onset of their illness, so that a comparison cannot justly be made of the mortality from this disease in military and civil hospitals respectively.

Having treated thirty-six cases of acute croupous pneumonia during the last fifteen months in the Royal Infirmary, Dublin, only one of which terminated fatally, giving a percentage of 2·7 deaths, and having carried out a definite line of treatment in all the cases with considerable success, I consider I am justified in laying stress on the details of this treatment, in the hope that some of my brother officers may be tempted to give the method a further trial. It may be said that the number of cases under review is not sufficient to enable an accurate estimate of the value of the treatment to be formed. I have thought of this, but as a considerable time would elapse before I had an opportunity of treating a much larger number of cases, I came to the conclusion that I had enough material to justify my writing on the subject.

In dealing with the subject of hydrotherapy in the treatment of acute croupous pneumonia, I am not going into the question of the "cold bath treatment," as it would be difficult to carry out in most military hospitals owing to there being no suitable movable baths in many of them; besides which the treatment would require a larger *personnel* than is always desirable or usually necessary. I have, however, used the cold bath in enteric fever with prolonged high temperature with beneficial results, but I consider it a more difficult treatment to carry out, and one requiring more anxious watching than ordinary sponging with iced water, and I do not think that it has any advantages over the latter. I have

always found that no matter how high the temperature may be in pneumonia, it can be readily brought down to a safe point by iced sponging, sometimes supplemented by the application of lumps of ice lightly rubbed over the body. The cold sponging does not appear to produce any shock, while the cold bath may, so that at present sponging with iced water and the application of ice itself, if necessary, supplemented by an ice-bag to the head and to the affected side (if the pain is severe), is the form of hydrotherapy which I carry out in all my cases of acute croupous pneumonia.

I may state that in my experience it is remarkable how few sick attendants understand how to sponge a patient with iced water with a view to lowering the temperature. The usual procedure adopted, unless specially instructed, is to sponge over a small part of the surface of the body at a time, dry it thoroughly and then cover it up and sponge another small surface, and so on, until the whole body has been sponged. The temperature is then taken and found to be very slightly lowered, if at all; and it is taken for granted that sponging has been given a fair trial and has failed. In this way hydrotherapy has got somewhat into disrepute, whereas, if carried out thoroughly I believe it to be most valuable, and a method of treatment which can be utilised in whatever part of the world the patient may be stationed.

In treating acute croupous pneumonia we are treating an acute infectious disease which happily, in the large majority of cases, runs a short course, the temperature falling by crisis, generally from the fifth to the ninth day, sometimes before the fifth day and sometimes later than the ninth day, but these are exceptions.

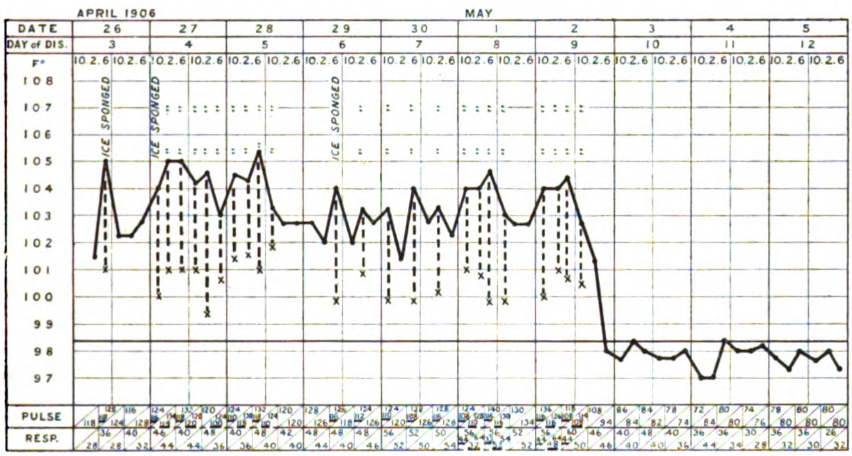
Death in pneumonia may be due to certain complications such as meningitis, endocarditis or pericarditis: apart from these complications, which are comparatively rare, the majority of cases die either as the result of the toxæmia or of heart failure. Unfortunately, with our present knowledge, we are unable to combat the toxæmia; we have no specific to neutralise the poison. Anti-pneumococcic serum has been prepared, but so far it has not been proved that it affects the course of the disease in any marked degree in man.

The majority of the deaths in pneumonia are caused by cardiac failure, and this is due either to the action of the specific poison, to the prolonged high temperature, or to over-distension of the right chambers of the heart.

It has been already pointed out that we cannot at present neutralise the poison and we cannot prevent the right side of the heart becoming over-distended, owing partly to the lung consolidation which is always present. We can, however, mitigate the deleterious effect on the heart muscle of the prolonged high temperature; this is brought about by lowering the fever by sponging at regular intervals with iced water, and notwithstanding that some authorities state that the fever is beneficial,

it has been abundantly proved that a high and continuous temperature has a bad effect on the heart muscle.

The routine treatment I have adopted in acute croupous pneumonia is, that all cases with temperatures of over 103° F. are sponged with iced water every four hours. In cold sponging with a view to reducing temperature, it is important to note that a large surface of the body should be sponged at the same time; begin with the front of the body, as low as the waist, and the arms, thoroughly sponge until the surface is quite cold to the touch, then dry and cover lightly, then sponge the legs, and lastly the back. Having finished the back, take the temperature under the tongue; in violent and delirious patients it may not be possible to take the temperature in the mouth; in this case we have to be guided by the lowered pulse-rate as indicating a lowered temperature. If the



Clinical Chart.

temperature has been reduced to 101° F. or thereabouts, the sponging may be stopped; if it has not been lowered sufficiently the procedure has to be repeated and lumps of ice used; sometimes it is necessary to continue sponging for three-quarters of an hour to produce the desired effect. To assist in lowering the temperature, an ice-bag may be applied to the shorn scalp; an ice-bag sometimes relieves the intense pain in the side which some cases suffer from; many, however, do not like it, and Dr. Burney Yeo states that it ought not to be applied over the cardiac area, owing to its having a depressing effect on the heart.

The beneficial effect of iced sponging is most marked in the improved condition of the pulse, which slows down and becomes stronger when the temperature has been brought down several degrees; this is well shown in the accompanying four-hourly chart, in which the dots indicate

the temperature before sponging whilst the crosses show the point to which the temperature has been reduced, and in the pulse column the figures show the pulse-rate before sponging, whilst those underlined show it after sponging.

The temperature rises slowly again after sponging to probably what it was before it was done, but it takes an hour or two to do so: during this period of lowered temperature the cardiac muscle recovers somewhat from the depressing effect of the higher temperature, as is shown by the improvement in the pulse, and as this sponging is done every four hours it can be easily realised to what a great extent the heart must benefit by this treatment.

I have never seen any bad results from iced sponging in pneumonia, and though the patient may occasionally look blue after it, especially if it has been necessary to prolong it, the pulse will invariably be found to have improved, and many patients get quite fond of it.

I have heard it said that patients are sometimes too cyanosed to be cold sponged; if the cyanosis is associated with a high temperature and failing pulse, cold sponging will, by lowering the temperature, enable the cardiac muscle to recuperate somewhat and thereby help in diminishing the cyanosis. I am of opinion that if hydrotherapy were more universally adopted as an important factor in the treatment of pneumonia, that the death-rate would fall considerably. It must be remembered that it is only an important detail, in the treatment; there are many other important factors, such as cardiac tonics, stimulants, &c., which have not been referred to, being outside the scope of this article.

A NEW ALL-METAL SYRINGE FOR EUCAINE.

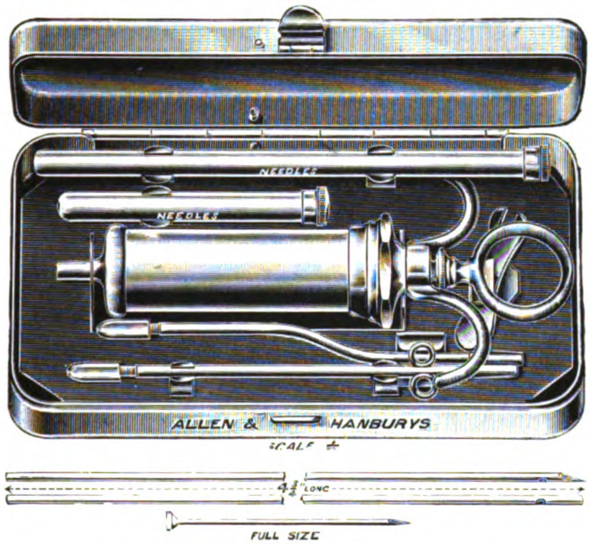
By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

This syringe, as depicted in the accompanying woodcut, is a modified pattern of the original instrument invented by Mr. A. E. J. Barker, F.R.C.S., and has been made by Messrs. Allen and Hanburys, Ltd., of 48, Wigmore Street, London, W., to my suggestion.

The syringe is of 20 c.c. capacity, and is constructed throughout of hard metal, consequently there are no parts which can get out of order during the process of sterilisation. The metal piston is so accurately ground to fit the barrel, that a little sterilised oil is required to lubricate it before use. It is graduated and fitted with a revolving stop. There is no possibility of fluid getting behind the piston when injecting into dense tissues, an advantage which users of the old syringe will at once appreciate. The connections of the needle carrier to the barrel are such as to prevent leakage at this point. The finger grips are large.

The Schimmel's needles used with this syringe are of larger gauge

than were formerly employed, and the long cannulæ, as shown in the woodcut, are also of correspondingly larger calibre. The needles do not corrode so quickly as the smaller ones, and can, therefore, be used many times. The needles and cannulæ are contained in two metal tubes.



The syringe and fittings are all nickel plated, and are fitted into an aseptic case. The whole of the apparatus can be sterilised whenever necessary.

The instrument has been tested very exhaustively in several large military hospitals during a period extending over six months, and has given complete satisfaction.

The cost of the syringe complete is 45s. (£2 5s.) in case.

A CASE OF PERSONAL INFECTION IN ENTERIC FEVER.

By Lieutenant-Colonel D. WARDROP.
Royal Army Medical Corps.

A somewhat remarkable instance of personal infection in enteric fever has recently come under my notice, by which three individuals contracted the disease while nursing one case.

Private M., Royal Irish Rifles, was admitted to hospital on November 23rd, 1906, as a transfer from the troopship "Plassy," suffering from enteric fever. The case was a very severe one and marked by violent delirium, severe diarrhœa, and inability to control his sphincters. These symptoms are especially mentioned because it is believed that they were the cause of the subsequent infections. From the date of his admission

to December 8th the patient remained in a condition in which the above symptoms were very marked.

During his illness he was tended by four nurses and three orderlies. Of these one nurse and one orderly had been the subjects of enteric fever, so may be considered immune. Of the others, Sister S. nursed him from the date of his admission; Private F. was on special night-duty over the patient from his admission up to December 3rd, when he was relieved; Staff-Nurse M. was night-nurse in attendance from December 1st. One and all of the nursing staff complained of the difficulties they had to contend with in the execution of their duties. Frequently the patient was seized with unusually violent paroxysms of delirium, throwing himself about the bed and requiring constant personal restraint. During these attacks he expectorated in every direction and voided urine and fæces freely.

On December 23rd Private F., who had been most assiduous in his duties as night orderly, reported sick, and ran a typical course of enteric fever. On January 1st Sister S., who had nursed Private M. for some five weeks, developed an attack of enteric fever, which also ran a typical course. On January 3rd Staff-Nurse M., the night-nurse in the Medical Division, who had assisted largely in the nursing of Private M., was taken ill, and was found to be suffering from enteric fever.

In all these cases the diagnosis was confirmed by the serum test, and in every instance a marked reaction was obtained. There appears to be no possible doubt that these three attacks were all contracted by personal infection while nursing Private M.

The contraction of enteric fever by personal infection is generally held up as an example of careless nursing, but in this instance it was not the case. Both nurses and orderlies were most careful to carry out the instructions provided for the nursing of this disease. No precaution could have prevented the free bespattering with infective material which they one and all were subjected to, and, although thorough cleansing and disinfection were always resorted to as soon as possible, frequently considerable time elapsed before this could be carried out. It is rather a case showing the danger that may at any time arise in the nursing of this class of disease. Had the nursing staff shown less self-effacement it might possibly have been better for them but not so well for their patient. The interesting point is the fact that one man infected three out of six of those in attendance on him, two of whom were already immune, a very unusual occurrence. How the infection occurred I am not prepared to say. Direct transmission through the air is admitted as a possibility, but I am inclined to think that these attacks were all due to some minute portion of infective material coming into contact with the mouth, either by direct bespattering from the patient or by brushing something from the face with an already infected hand.

NOTES ON A CASE OF SUDDEN DEATH FROM "SHOCK," FOLLOWING A BLOW OVER THE EPIGASTRIUM.

BY CAPTAIN H. P. W. BARROW.
Royal Army Medical Corps.

ALTHOUGH the above-noted injury is mentioned in text-books as a cause of sudden death, cases illustrating it are so rare that the following seems to be worth recording.

Driver J. N., R.H.A., was brought up to the Auxiliary Hospital, Woolwich, at 12.50 p.m., on December 14, 1906. On examination he was found to be dead.

Previous Medical History.—Unimportant.

History of Injury.—(As elicited from his comrades, and partly taken from a newspaper report of the inquest.) Driver N. was grooming his horse down at midday stables. He was wearing stable clogs, and the stable floor was of cobble. He was standing in front of and over the horse's head, grooming its neck, the horse's head having been bent down for that purpose; the horse suddenly "playfully" threw up its head, catching N. a blow—which appeared to the onlookers a slight one—over the "stomach." N. fell backwards, owing, his companions imagined, to his clogs slipping on the cobble paving stones, and in falling cut the back of his head "behind the right ear." As he did not attempt to get up his companions went to his assistance, and found that he was not breathing. They at once procured a stretcher and brought him up to the hospital.

Condition on Admission.—Dead. Very extreme pallor of exposed cutaneous surfaces. There was a contused wound over the right parietal bone, immediately above and behind its centre. This did not expose the bone. There was no bleeding from ears, nose or mouth, and no evidence of any external injury.

Post-mortem *Examination held Twenty-four Hours after Death.*—*Post-mortem* rigidity extreme. A contused wound of scalp as described above, not exposing bone. No bleeding from ears, nose or mouth, and no subconjunctival hæmorrhage. No evidence of any injury elsewhere. On removing the "skull cap" the dura was seen to be somewhat pale, otherwise normal. Brain removed, vault and base of skull carefully examined, but not the slightest trace of a fracture was seen. No pressure on the cervical cord evident from above, and no dislocation of odontoid process palpable from above.

Brain.—Weight 55 ounces, healthy; no hæmorrhage into its substance found after many careful sections; cerebellum, pons and medulla healthy and no hæmorrhage into their substance. *Tongue, pharynx, œsophagus, larynx, trachea* and *lungs* normal. *Heart:* 14 ounces; some hypertrophy, muscle healthy and valves absolutely normal; no atheroma of big vessels. *Liver* (weight 72 ounces), *spleen* (weight 12 ounces), and *kidneys* (right, weight 6 ounces, left, weight 7 ounces), very congested, otherwise normal.

Stomach: Contained a small quantity of well-digested food; somewhat congested, otherwise normal. *Intestines:* Congested, otherwise normal. *Peritoneum:* Healthy. The *abdominal cavity* generally had a very congested appearance. The vessels over the splanchnic area were full and dilated. I removed the *cervical cord* and found it healthy and intact, and the odontoid process unbroken and in its proper position.

Travel.

NOTES MADE DURING A TOUR AT D'THALLA IN THE ADEN HINTERLAND.

By Captain J. TOBIN.
Royal Army Medical Corps.

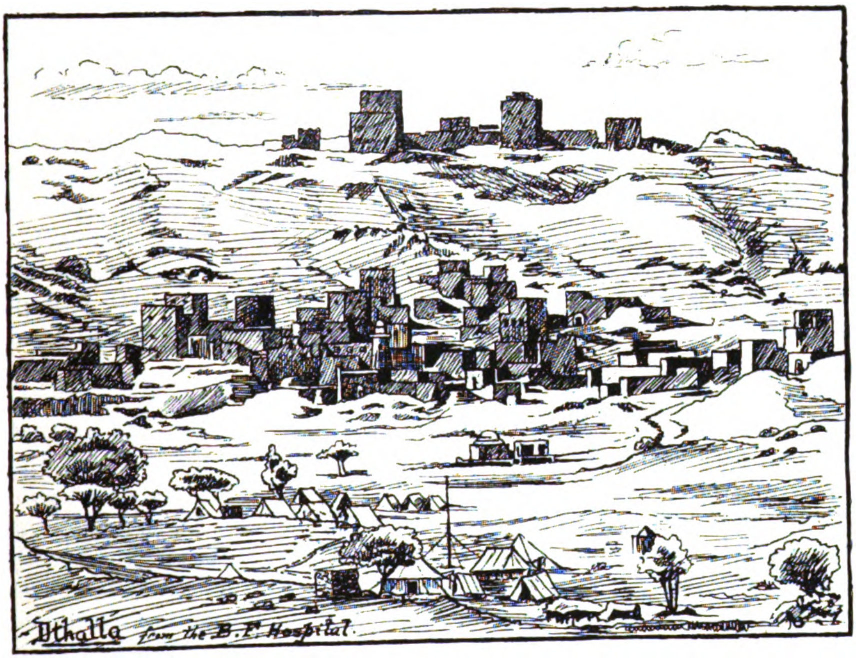
D'thalla is distant about seven days' march from Aden, travelling over a caravan route of sandy desert and dried river-beds, and consists of a number of stone buildings built on the side of a hill. It is ruled over by an Ameer, and like all Arab villages, has its sacred well and mosque.

Climate.—The cold weather extends from October to March; during the months of December and January it is quite cold at nights, one requiring three blankets to sleep comfortably. Fogs are common at this season, and often hang about for several days at a time. During the cold season there is little sickness amongst British or native troops. *The rainy season* is from June to September, rain-showers lasting several hours, occur generally in the evening, and at night are attended by thunder and strong winds. *The hot season* is not trying. It extends from March to June, and the highest register of the maximum thermometer was 93° F. It is of interest to note the difference between the climate of Aden and D'thalla, yet the latter place is only seven days' march from the former, and compares favourably in climate with most Indian hill stations.

Nature of the Country.—It is a country of low-lying hills intersected by narrow valleys sparsely covered with scrub. During the rainy season the valleys are under cultivation with Iowari and Bajree grain. Plots of ground, constantly under cultivation, properly manured and watered daily, will grow most English vegetables. A vegetable garden started by Brigade-Major S. M.

Edwards, D.S.O., supplied excellent vegetables for the troops, and was the means of nipping in the bud what threatened to be a serious outbreak of scurvy. The water is got from deep wells of good quality and is abundant.

Trade.—Cattle.—Milch cows, some excellent milkers. Slaughter cattle of fair quality; meat is tough and stringy. Sheep about D'thalla of bad quality, but where well fed, as in Smaan, the mutton is excellent. Horses from Yemen of poor quality, are



weak-hocked, curby, broken-winded, and most have splints. Goats in abundance. *Fruit.*—All fruit comes from Yemen. Grapes in season, pears, apples, sweet limes, and dates of excellent quality. *General supplies.*—Honey in abundance, but of a smoky flavour. Milk, also of a smoky flavour, adulterated with camel's milk. Wood plentiful; also country tobacco and Turkish cigarettes. *Ghee* of bad quality. Iowari and Bajree grain in abundance.

Camels are all baggage animals in the country about D'thalla. They are short-haired and able to endure thirst and extreme heat. Their average load is about 200 lbs. They are weak, badly fed, and badly groomed.

Kaat, a small tree, carefully planted and watered, is seen near every village in Southern Arabia. The natives chew the leaves, which are bitter and astringent. It has stimulating properties, produces wakefulness, and, in large quantities, hallucination. It is used as an aphrodisiac also. It is chewed by young and old, Turk, Arab, and Jew alike.

Coffee.—Coffee comes from Yemen, and is its chief source of wealth. When the berries are ripe they are plucked and dried in the sun. Pure Yemen and Mocha coffee is excellent, but most of the coffee coming into D'thalla is adulterated. Great care is taken in the cultivation of the coffee plant.

Diseases amongst British and Native Troops.—Dysentery.—Ulcerative dysentery of a severe type was common. As to causation, Captain F. F. Carroll, R.A.M.C., Senior Medical Officer, Aden Column, went into the matter very fully, and assembled several medical boards to investigate the cause. The general opinion formed was that (*a*) the predisposing cause was chill contracted by sleeping on the ground; (*b*) enfeeblement following previously contracted malaria, most cases occurring amongst the 1st Hampshire Regiment, who came from Dar Akan, where malignant malaria was rife.

Malaria.—It is of interest to note that there was very little malaria at D'thalla, their being no Anopheles mosquitoes at that place. All cases of malaria were brought from posts along the lines of communication, viz., Mussimir, Dar Akan, Nobat Dakim. These posts were hotbeds of malignant malaria. All the elements for malarial infection were present: (*a*) Literally swarmed with Anopheles; (*b*) pools of water laden with algæ; (*c*) all inhabitants of the villages malarial-infected. The malarial index, as ascertained by Captain J. Macpherson, I.M.S., and myself at Mussimir, was 70 per cent. *Prophylaxis.*—Quinine prophylaxis was rigidly carried out, giving daily an issue of quinine, as also the German method of larger doses of quinine, but less frequent. The men disliked taking quinine; continued use of the drug seemed to cause indigestion; many cases of urticaria were attributed to taking quinine, and the other attendant symptoms, such as deafness, palpitation, headache, giddiness, &c. I had one patient, who every time he took a dose of quinine contracted quinine fever. We carried out destruction of Anopheles larvæ as best we could with the means and time at our disposal, but with a column moving through a malarious district it is impossible to carry this out efficiently. Our experience taught us that the only efficient

prophylaxis against malarial infection was the regular use of mosquito nets of fine mesh.

Treatment.—Injections of quinine, hydrochlor., grs. 20, subcutaneously, gave the best results; one injection sufficed to prevent the recurrence of the fever from fourteen to thirty days. Removal from the infected area and change of climate was in many cases the only method of curing the disease.

Enteric Fever.—Only a few sporadic cases occurred.

The Diseases of the D'thalla Arabs.—Chronic ulcers of the legs were very common; to heal them the natives tied on plates of tin. Chronic hydrocele was common. Eye diseases, ulcers of the cornea, conjunctivitis, trachoma, tuberculosis of lungs and joints and syphilis were also met with. One was often asked to treat impotence, a common ailment amongst the Jews. Many cases of deformity were seen, in particular, club-foot.

Reviews.

PULMONARY PHTHISIS, ITS DIAGNOSIS, PROGNOSIS AND TREATMENT. By H. Hyslop Thomson, M.D., Visiting Physician to the Consumption Sanatorium of Scotland, Bridge of Weir, N.B. London: John Bale, Sons and Danielsson, Ltd. Pp. 188, with twenty charts. Price 5s. net.

In view of the interest recently taken by Members of Parliament in the question of pulmonary tuberculosis amongst soldiers, and the letters which have appeared in the medical press on the subject, Dr. Hyslop Thomson's work claims the attention of the military physician. The book is divided into four sections, dealing with (1) the diagnosis; (2) the prognosis; (3) the treatment of phthisis; and (4) tuberculosis in childhood.

In the section on diagnosis the author brings out the difficulties in the way of diagnosing incipient pulmonary disease, and shows how true are the remarks of "Surgeon-General (Retired)" in the *British Medical Journal* for March 9th, that cases of tubercle of lung may and do exist in barracks as foci of tuberculosis, "because the cardinal symptoms of the disease being absent or indefinite the suspicion of pulmonary mischief is not entertained, and consequently examination of the chest is omitted."

Work has often to be done at high pressure in medical inspection rooms in the Service, and the clinical picture of a typical case of early tuberculosis of the lung, with which we are so familiar in the text books, is not likely to be so useful to the military physician as the suggestive list of past and present departures from the normal state of health which Dr. Thomson points out should raise suspicions, and lead to a careful physical examination. An important point which is duly emphasised is

the necessity for taking the temperature four-hourly in cases of suspected tubercle of lung. This is a practice which is sometimes omitted, but of the utmost importance, as the temperature occasionally rises to 100° F. at noon in these cases, although normal in the morning and evening. The use of tuberculin for diagnostic purposes is not likely to recommend itself to military physicians, but the X-rays might be used more extensively in elucidating obscure cases in military hospitals. Dr. Thomson thinks that "in the Rontgen rays we have a useful means of assisting stethoscopic examination in detecting early tuberculous lesions of the lungs."

The chapter on differential diagnosis is useful and suggestive, but the author might with advantage have devoted more space to this important subject.

The section on prognosis is good, and the interpretation of physical signs and important symptoms is judiciously dealt with. One notes with satisfaction that the necessity for careful examination of the urine is advocated in all cases, but regrets that while Dr. Thomson summarises the opinions of others with regard to Ehrlich's diazo reaction, he does not give his own views and experience with regard to this interesting test.

The section on treatment is the best in the book, and when a military sanatorium for consumptives is established the commandant will find much to interest him in this part of Dr. Thomson's book.

The chapter on specific treatment summarises briefly, and, on the whole, satisfactorily, the work of Koch, Maragliano, Marmorek, Behring and others in the search for a specific for the white fiend.

The final section on "Tuberculosis in Childhood" is of interest not only to physicians but to students of State Medicine, as it shows the appalling apathy of this country, as compared with France, in adopting preventive measures.

The book is well printed on good paper, and is an important contribution to the literature of tuberculosis, especially from the general practitioner's point of view. In the next edition the author will require more careful proof-reading, as the typographical errors are somewhat numerous, and, moreover, bred as we all are in the Army, like Colonel Forman, "to stick slavishly to the Nomenclature of Diseases as propounded by the Royal College of Physicians" (vol. vii., p. 261), one ventures to express a pious hope that for future editions Dr. Thomson will select a less alliterative and more scientific title.

R. J. Blackham.

The Past, Present and Future of the School for Advanced Medical Studies of University College, London. By Rickman John Godlee, Holme Professor of Clinical Surgery; Surgeon in Ordinary to H.M. the King. London: John Bale, Sons and Danielsson. 46 pp., 28 illustrations. 2s. 6d. net.

Mr. Godlee's most interesting introductory address, delivered at the opening of the winter session of 1906, now makes its appearance in book form, with the addition of many instructive notes and a number of excellent illustrations. The volume gives an account of the circumstances under which "The University of London," which, ten years later, became University College, was founded in 1826, and traces the history of the

College and Hospital up to the present day. It will be read with profound interest, not only by "U. C. H." men, but by all who are watching the evolution of medical education in London, in which University College has played so notable a part. It is much to be hoped that the Hospital and its new School for Advanced Medical Studies will not have their work hampered by lack of funds, and that they will be able to maintain in the future the high standard and ideals that they have always upheld in the past.

THE DIAGNOSIS OF TUBERCULOSIS OF THE LUNG. With special reference to the early stages. By Dr. K. Turban. Translated by Egbert C. Moreland, M.B., B.Sc.Lond. London: John Bale, Sons and Danielsson, Ltd. Price 5s. net.

This book, as noted by the translator, consists of the first two sections of Turban's *Beiträge Zur Kenntnis der Lungen-Tuberculose*, published in 1899, and is divided into three sections, dealing with: (1) A discussion relative to the commencement of tuberculosis of the lung; (2) a classification; and (3) the physical examination.

It is generally recognised that too much stress cannot be laid upon the value of an early diagnosis of tubercle of the lung. Not only is it of the highest importance to the patient and to those in contact with him, but also much of the success to be expected by treatment in sanatoria will depend on the stage of the disease; the earlier the stage, the better chance there is of arresting the morbid process. To this end the author has particularly directed his attention in Section I. to a discussion of the early diagnosis; he points out that before tubercle bacilli appear in the sputum the disease may be demonstrated clinically, a statement with which all will probably agree. In the differential diagnosis Sticker's reaction is noted, and Dr. Turban confirms the test, with the exception that tubercle bacilli are not always to be found in the sputum of undoubted cases of tuberculosis. The determination of the opsonic index of Wright is only alluded to in a footnote, as the book was published in 1905, but the author's experience in this respect will be looked forward to with interest.

In Section II. Turban's own classification into three stadia—(1) disease of slight severity affecting at most one lobe or two half lobes; (2) disease of slight severity more extensive than first, but affecting at most two lobes, or severe, and affecting at most one lobe; (3) all cases of greater extent and severity than second—is given and explained, but to be of general utility would require to be universally adopted. It certainly is clear and simple, and some such classification would, we think, be of value in Army returns.

Section III.—The physical examination in tuberculosis of the lung is dealt with in a masterly manner and with a minuteness of detail that is hardly to be acquired from any one book on the subject. The Section is full of valuable ideas, and the author's experience set forth will prove of the greatest help in arriving at, by examination of the patient, an early diagnosis of the disease.

The classification of râles as given on page 102 is rather extended, and probably difficult to acquire by the ordinary observer, but confusion certainly prevails in distinguishing between moist and dry râles. The

schema on page 117 is admirable and well worthy of study. The book concludes with a summary of references, in which we notice rather an absence of reference to the literature of British writers on the subject. On the whole, we can confidently recommend this work as being one of the best on the subject with which we are acquainted, and thanks are due to Dr. Moreland for his excellent translation.

W. W. O. B.

THE RÖNTGEN RAYS IN MEDICAL WORK. By David Walsh, M.D.Ed. London: Baillière, Tindall and Cox, 1907. Price 15s.

With commendable energy Dr. Walsh has brought the present edition well up to date. Readable throughout, it is a work of valuable reference, and, like the earlier editions, will be found on the bookshelves of the majority of X-ray experts.

In the table of exposures, a little information regarding the intensity of the tube would have been valuable to the beginner or casual worker. Exposure values can only be approximate, as so many important factors are to be reckoned with in each. The first to receive consideration, and to which all others lead up, is the intensity or penetrating power of the tube—the *pons asinorum* in X-ray practice. Hence, a given exposure is only admissible under certain well-defined conditions.

The part dealing with the generation of electrical current during active service might have, with great acceptance to the military surgeon, been brought more up-to-date. A bicycle arrangement in theory might appear feasible, but when subjected to careful consideration shows its utter worthlessness practically. Even two men in a temperature of 110° F. in the shade cannot be expected to produce energy amounting to nearly a quarter horse-power for more than ten minutes at one time. Hence, the refresher the accumulator receives, especially when the output is great, can hardly be looked upon as a solution of the difficulty. Surely the author could have chronicled the more effectual methods used during the late South African War. It is to be hoped that should another edition be brought out the author will devote some of his talents in assisting the military surgeon to improvise methods for generating electricity under service conditions.

A careful study of this book will repay anyone seeking reliable information on important points. In conclusion, it should be mentioned that the first edition was amongst the earliest works published on X-rays, and Dr. Walsh deserves the thanks of all X-ray workers for the way he has thought out and rendered easy of accomplishment many difficult and obscure problems connected with the subject.

F. BRUCE.

Current Literature.

Demonstration of Typhoid Bacilli in Drinking Water by a New Method.—(*Hyg. Rund.*, December 15th, 1906). Drs. Ditthorn and Gildemeister, of the Posen Hygienic Institute, describe a method of detecting enteric bacilli, even in small numbers, by treating the precipitate obtained by perchloride of iron (Müller's method) with solution of ox-gall and plating out.

W. G. M.

Medical and Surgical Bags for use with Camel Corps in the Sahara.—M. Aubert, Médecin-aide-Major, first class, has a practical and instructive article on this subject in the *Archives de Médecine et de Pharmacie Militaires* for December, 1906. The company of Sahara troops, to which he is attached at Tuat, consists of about 600 men, organised in three sections of 135 men each, and several small independent detachments. The sections are employed hundreds of miles away from any of the established military posts, such as Beni Abbes, Adrar or Timinoun, and each section is composed of 75 men mounted on camels (*méharistes*) and 60 infantry. The necessity of having them supplied, therefore, with sufficient medical and surgical material on the spot needs no argument.

Every man is provided with a first field dressing, but this is not enough, and a difficulty arises in carrying the additional medicines and surgical material required. The regulation medical panniers (*cantines médicales*) are not suitable for transport in the Sahara. They are made of wood and the contents generally arrive at the end of a journey broken or damaged. The ambulance bags (*sacoches d'ambulance*) are also unsuitable. Although they have not the same drawbacks of weight and difficulty in loading, which the panniers possess, they are apt to cause sores, and when strapped on to a camel, already carrying a man, are likely to overload the animal.

M. Aubert proposes using a kind of bag known under the name of *mezoued* or *dabia* in the Sahara. The bag is made of sheep or goat's skin, roughly but solidly prepared. The skin forms a large sack, with a wide, open mouth at the upper extremity, small, narrow and closed at the lower extremity. The usual dimensions are, *depth* 39 to 58 inches, *circumference at mouth* 31 to 39 inches, at the *middle* 18 to 27 inches, at the *lower end* 4 to 10 inches. The natives sling these *mezoued* from the saddle by a leather strap, and pack them with clothes, provisions, utensils, &c., for the journey. They are strong, easily carried, light and cheap.

The author describes his method of modifying a *mezoued* for the carriage of medical and surgical material on camels. He divides the upper half into two tiers, the higher containing pouches, like the pouches on a bandolier, for holding the metal tubes with drugs, and the lower a pocket for an instrument case, with bandolier pouches on either side to carry tubes of serum and antiseptics. The lower part of the *mezoued* is filled with dressing material. The contents are arranged as follows:—

(1) *Drugs.*—(In pouches in the upper part of the sack.)

Name	How Carried	Quantity	Remarks
Quinine	4 tubes ..	100 grammes	In 0·25 gramme tabloids.
Antipyrin	1 tube ..	10 ,, ...	In powders of 0·50 gramme.
Ipecacuanha	2 tubes ..	30 ,, ...	,, 1 gramme.
Opium..	1 tube ..	100 pills	In pills of 5 centigrammes.
Soda bicarbonate ..	2 tubes ..	20 grammes	With 1 gramme measure.
Mercury iodide ..	1 tube ..	200 pills	In pills of 25 milligrammes.
Potassium iodide ..	2 tubes ..	60 grammes	In two packets.
,, chlorate ..	2 ,, ..	60 ,, ...	In six packets.
Bismuth	2 ,, ..	70 ,, ...	With a 1 gramme measure.
Phials of ether ..	1 tube ..	0·50 gramme per cc.	4 phials for hypodermic use.
,, quinine ..	1 ,, ..	0·50 ,, ,,	4 phials of hydrochlorate of quinine, hypoderm. sol.
,, caffeine ..	1 ,, ..	0·25 ,, ,,	4 phials of caffeine and benzoate of soda of hypoderm. sol.
,, morphine..	1 ,, ..	0·01 ,, ,,	4 phials of hydrochlorate of morphine, hypoderm. sol.
Paregoric elixir ..	1 ,, ..	30 grammes	In a yellow glass bottle.
Sulphate of zinc (for eye cases).	1 ,, ..	30 ,, ...	In a stoppered bottle.
Nitrate of silver (for eye cases).	1 ,, ..	30 ,, ...	,, ,, ,,

(2) *Antiseptics.*—(In pouches on one side of the instrument pocket.)

Name	How Carried	Quantity	Remarks
Sublimate	2 tubes ..	10 grammes	In 1 gramme packets.
Permanganate ..	2 ,, ..	80 ,, ...	With a 1 gramme measure.
Sal ammoniac ..	1 tube ..	30 ,, ...	In stoppered bottle.

The tubes are like those containing the drugs, but they are painted red. The number of tubes and pouches may be increased at will according to the dimensions of the *mezoued.*

(3) *Serum.*—(In pouches on either side of the instrument pocket).

1 Pravaz hypodermic syringe.

4 Tubes of antivenom serum.

(4) *Instruments.*—(In pocket.)

(*a*) 2 Bistouries.
1 Tooth forceps.
1 Pair of scissors.
2 Forceps, acupressure.
1 Catch forceps.
1 Hollow sound.
1 Thermometer.
1 Silver nitrate pencil.
1 Metal box in three compartments, containing silk ligatures, pins, and suture needles.

(*b*) 4 Sets of perforated metal splints, 7 inches long, with tapes attached.

(*c*) Iodoform duster.

(5) *Dressing material.*—(In lower part of sack.)

15 First field dressings.
Rubber adhesive plaster, about 9 inches wide, in tube.
Body bandages, 2.
Calico roller bandages, 10.
Gauze roller bandages, 10.
Sublimate gauze compresses, 4.
Absorbent cotton wool, 4 packets of 50 grammes each.
Web straps with buckles, 10.
Triangular bandage sling, 1.

The price of the empty *mezoued* is 5 to 10 francs, and 15 to 20 francs equipped, as compared with the regulation *sacoche d'ambulance*, which costs 40 francs equipped. The weight of the *mezoued* is 0·600 kilogrammes empty and 6 kilogrammes full, compared with 5·400 and 11·700 kilogrammes in the case of the *sacoche d'ambulance*.

M. Aubert has had these camel bags on trial for a year in the Sahara, and the above contents are what he finds most serviceable He draws special attention to the hypodermic solutions and antivenom serum, which have been of great use. He recommends a scale of two *mezoueds* for each section of 135 to 140 rifles.

W. G. M.

Recent Work on the Etiology of Hog-Cholera.—Apart from the general interest of the subject, the fact that the reputed causal organism of this disease—*Bacillus suipestis*—occasionally gives rise to disease in man, the symptoms, in some cases, closely approaching those of typhoid fever, makes this a subject of interest from the point of view of human medicine. In the *Zeitschrift für Infectionskrankheiten parasitäre Krankheiten und Hygiene der Haustiere*, Zweiter Band, 2-3 Heft, 1907, Ostertag and Stadie confirm the results recently obtained by Dorset and Schweinitz, Bolton and McBryde in America (*Bulletin*, No. 72, U.S. Bureau of Animal Industry, Washington, 1905). The important conclusions which they arrive at as a result of a long series of experiments are: (1) that the German *Schweinpest*, like the American hog-cholera, is caused by a virus which is capable of passing through a fine filter; (2) that the *B. suipestis* only secondarily invades the body of the sick animal. The authors state "that in most countries for years—in America for over fifteen years—hog-cholera has been investigated; and that the *B. suipestis* should have been made the starting-point for bacteriological campaigns against it is a deplorable error. The *B. suipestis* had fulfilled Koch's three postulates, and was, therefore, generally recognised as the cause of hog-cholera." The question as to whether the *B. suipestis* can produce disease in the human body will have to be reconsidered in the light of this fresh addition to our knowledge. The history of the etiology of disease repeats itself in this work on hog-cholera. The cause of yellow fever was formerly thought to be the bacillus of Sanarelli, and now, as is well known, it is recognised as having nothing to do with the etiology of the disease at all. So, also, the Streptococcus of Castellani was regarded by its discoverer as being the cause of sleeping sickness, and that likewise has had to give place to the true causal agent of this disease. It further illustrates the extreme importance of accurate investigation into the etiology of disease, as otherwise an enormous and fruitless expenditure of money, time and labour may be made on preventive measures based on inaccurate work.

E. D. W. Greig.

The Cultivation of Spirillum obermeieri.—In a recent note in the *Journal of the American Medical Association*, December 29th, 1906, vol. xlvii., Növy and Knapp give the results of some very interesting and important experiments on the cultivation of *Spirillum obermeieri*. In the introductory remarks they fall into an error. They say "On the other hand, the African relapsing fever, known also as tick fever, has

been shown conclusively to be due to a different organism, the *S. duttoni*. As far as we know the first observation on this organism was made by Dr. D. Nabarro, of the Sleeping Sickness Commission, who noted the presence of spirilla in the blood of a patient in Uganda as early as August, 1903, but this fact was not published until 1905." Növy and Knapp are correct in stating that the spirillum of African tick fever was first discovered by the Sleeping Sickness Commission of the Royal Society in Uganda, but are wrong in ascribing it to Nabarro alone. The Report referred to as published in 1905 was a joint one by Nabarro and Greig (Report V. of Royal Society's Sleeping Sickness Commission). The observation, however, was made by the Commission prior to Colonel Bruce's departure for England, so that the discovery was made by the Commission as then constituted (Bruce, Greig and Nabarro). The work of the Commission was the starting-point for subsequent work on this subject in Uganda. The method employed by Növy and Knapp for the cultivation of the spirilla is to grow them in collodion sacs filled with rats' blood placed in the peritoneal cavity of a white rat. The sacs were removed from the peritoneal cavity three days later, and were found to contain active spirilla and in increased numbers. From the sacs, transplants were made to new ones, and the result was equally satisfactory. The spirilla were found to be in an extremely active condition and were undoubtedly multiplying. From this time on the transplantations were made regularly, every three or four days, from sac to sac. Each sac had a capacity of 2·5 to 3 cc., and was sealed, to leave within as little air as possible. Since October 13th the spirilla have been carried through twenty consecutive passages in sixty-eight days. The spirilla in the sac are never as numerous as in the blood of rats. The inoculation of the sac contents (blood or serum) into rats, it is interesting to note, is followed by a mild infection in which the spirilla are not much more numerous than in the sacs. Moreover, in such infection they persist for a day or two longer than is the case with active virus. The spirilla have preserved their form unchanged. The division, as in the case of the blood, is transverse. In sac cultures in rat serum they have effected seven consecutive passages in such serum in the space of twenty-four days. The serum cultures, although totally devoid of corpuscles, were in every respect as rich in spirilla as the blood cultures. The conclusion to be deduced from these experiments is that multiplication of spirilla may take place without any intracellular stage. The occasional presence of spirilla in a cell is to be regarded as an accident rather than as an expression of an unrecognised cycle.

E. D. W. GREIG.

Correspondence.

GUN DEAFNESS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

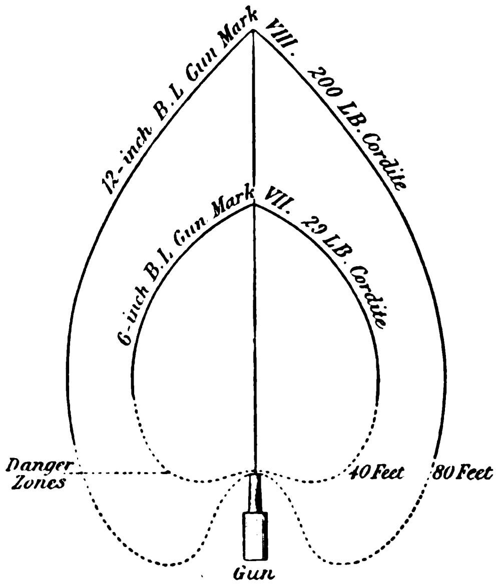
Dear Sir,—As one whose duties call for frequent attendances at gun-practice, I wish to state, in response to Lieutenant-Colonel Fletcher's letter in the last issue of the Journal, that my attention was first drawn to a substance known as modelling clay as an ear stopping for mitigating the effect of heavy gun-firing on the membrana tympani, by the Chief Inspector in Gunnery, R.A., at this Station (Plymouth). The latter, who was given the clay pellets by a naval lieutenant, reports favourably of its use, and I believe it is extensively employed in the Navy and much liked. Following out this idea, I have recently experimented with a somewhat analogous preparation known as Harbutt's Plasticine, used for modelling purposes in schools, &c. It is sold in different size packets, or a pound can be had for 1s. 6d.

The Agents are Chapman and Hall, Ltd., 11, Henrietta Street, Covent Garden, W.C. The chief advantages that I claim for this substance are: that it is composed of perfectly harmless materials, has highly antiseptic properties, is easily moulded to shape required, and does not dry or shrink, being unaffected by heat, cold or water. Moreover, it is free from the objections noted with reference to the use of wool or "waste," being perfectly clean, and not causing subsequent irritation to the auditory apparatus.

Concerning the prevailing idea against taking up a position in direct line in rear of the gun, this is owing to the possibility of an accident in which the breech might be blown out, or the shell explode unexpectedly, as sometimes happens after a miss-fire; but when the gun itself bursts, such as occurred last summer at Stadden, the safety zone is not easily defined, inasmuch as on that occasion a boy who was standing 150 yards away sustained a compound fracture of the arm as a result of being struck with a fragment of gun metal, whilst one of the Volunteers who was serving the gun got knocked over and became partially paralysed from the shock, and had subsequently to be invalided.

As to the enforcing of measures of a precautionary nature against gun-deafness, so far, no rules on the subject have been promulgated by the Army medical authorities; but that this is a matter of increasing importance goes without saying, and is bound sooner or later to come to the front. I have, however, been able to obtain from the Royal Garrison Artillery orders a diagram showing the curves of safety, which cannot fail to prove interesting to anyone engaged in attendance at gun practice. From this it will be seen that, taking, for example, a 6-inch B.L.

gun, Mark VII., the danger zone corresponds to the dotted line within 40 feet of either side of the muzzle of the gun, and that of the 12-inch B.L., Mark VIII., extending to 80 feet, following the direction of the dotted line, the guns of intermediate calibre showing a danger zone of about 10 feet extra for each inch. In action it is necessary to bear these figures in mind when taking up positions, to ensure that the guns are not ranged too close to each other. Although the 12-Pounder Q.F. gun is of much smaller calibre than those mentioned, I think the effect on the tympanum far more trying, and owing to the greater celerity required in the loading of this class of ordnance accidents are more likely to occur, especially in the manipulation of the breech.



With reference to keeping the mouth slightly open, there are good physiological grounds for this precaution, which were brought home to my mind when attending gun practice some time ago. The firing took place close to a large wooden shed, used as a Royal Artillery store, the walls of the structure being formed of heavy planks partially overlapping each other. On this occasion the usual procedure of throwing open all doors and windows was omitted or forgotten, with the result that, after a few rounds, a portion of the side wall was burst open, causing a large rent, due to the concussion or "blast" of the firing. It is, therefore, obviously wise to maintain the "open door."

There can be no doubt that artillerymen—especially the Royal Garrison

Artillery—suffer more from ear troubles and deafness than other branches of the Service, and it is quite a common practice to have men attend at the Medical Inspection Room for the purpose of having their ears syringed. No doubt the firing has some special effect either in breaking up the wax in the ear or in its secretion; be this as it may, I find that by dropping in some slightly warmed almond oil over-night and syringing with warm soap and water on the following morning, the desired relief is generally obtained and no further trouble experienced for the time being.

In an interesting discourse, given, I think, by Mr. Cantlie, some months ago, at the United Service Institute, on the subject of gun-deafness, a preparation composed of animal wool and moulder's clay was advocated as an ear-plug during gun-firing, and is worth a trial; but from its antiseptic properties, and the facility with which it can be moulded into the external meatus, I do not think any protection yet devised superior or equal to Plasticine, a report on the more extended use of which I shall look forward to seeing in future issues of this Journal.

I am, &c.,

P. G. Ievers,

Major, R.A.M.C. (R.).

Fort Stamford, Plymouth,
April 10th, 1907.

N.B.—Since writing the above, I distributed Plasticine in pellets amongst a number of men for trial during gun-firing, and found that it proved highly successful in each instance, although experimenting only on those who had previously suffered more or less from gun-deafness.—P. G. I.

PREVENTIVE MEDICINE IN THE ARMY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I have read with interest the letter of Major S. F. Green on the above subject, which appeared in your issue of March last. As a military Sanitary Officer I would like to say a word on the subject.

While entirely in agreement with Major Green's contention that the Sanitary Officer reports to the Principal Medical Officer normally, still in a large area cases must frequently arise when it is necessary to take immediate action on the spot, and to report to the Principal Medical Officer afterwards. Outbreaks of infectious disease, for example, refuse to be restrained by the bonds of red tape, and in such emergencies the military Sanitary Officer must go direct to the General Officer Commanding, or other executive officer on the spot, who can at once transport, segregate, or isolate, as the occasion requires. The fact is, that in a large area the duties of the military Sanitary Officer are those of a Medical Officer of Health, and most of his outside work is done in

connection with Administrative Medical Officers, Commanding Royal Engineers and Commanding Officers, while he reports at intervals to the Principal Medical Officer. The same thing must happen in war time, and if the Principal Medical Officer cannot so far trust his Sanitary Officer it is presumed he will promptly get rid of him as useless. In small areas, like some of the colonies, the case is different, and the military Sanitary Officer's duties are confined to laboratory work, as the Principal Medical Officer is always on the spot, and there is no room for initiative on the part of the Sanitary Officer. This, however, does not tend to make him efficient for his duties in time of war.

The post of military Sanitary Officer will not be at all an enviable one in war if he is deprived of liberty of action, as he will always be the first person called to attend when infectious disease breaks out.

May I, in conclusion, make a strong protest against the ungrammatical appellation of "Sanitary Officer"? We talk rightly of "sanitary dust-bins," "sanitary carts," and so forth, but unless we mean that all other officers are insanitary and unhealthy we should be styled "Sanitarian Officers," as is the case in foreign armies, and this would rightly define our duties.

I am, &c.,

Jamaica, *March* 27*th*, 1907.

E. Carrick Freeman, *Major*, *R.A.M.C.*

A REJOINDER (*vide* EDITORIAL, Vol. VIII., No. 3).

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—It is just about as unprofitable to argue with an Editor as it is to reason with a Bengal tiger when he has got you down, both of them are so manifestly "top dog." Once in the rashness of my youth I tried it, with the result that the said Editor, after devoting a column or so to obloquy and genial abuse at my expense, blandly closed the controversy in the curt footnote, "this correspondence must now cease." They say, "there is no fool like an old fool," and instead of profiting by my youthful experience, I am once more laying myself open to pulverisation.

And first I should like to say, that in writing my original letter nothing was further from my mind than to "crab" the Journal, or to find fault with its Editor. It has done, and is doing, good work for the Corps, and we are all too sensible of the obligation under which we lie to its conductor—a thankless job at the best—to be so graceless as not to be grateful. Rather was it an attempt, by implication and suggestion—good, bad, or indifferent—to give a helping hand along the path to success—or should I not say *increased* success?—and assist in the regeneration of those one hundred and twenty backsliders. I did not know, when I wrote, that there were so many, and I am sorry to learn it now, nor have I much patience with them, for surely, there is such a thing as

loyal and unselfish support of an avowedly good object, in spite of individual indifference or distaste. Perhaps I am not so forbearing as I might be, but I can scarcely concede much weight to the *res angusta domi* argument. I appeal, therefore, to all these officers (and retired officers also) to wipe out this slur upon their loyalty forthwith.

Is it not a bit unkind to suggest, as you do—by implication anyhow—that I have contrasted two kinds of papers, "The Investigation of Malta Fever," and "The Humour of Indian Sanitation," to the detriment of the former? I did not! I am a shocking bad pharmacist, I admit, but I at least have a sufficient knowledge of incompatibles to avoid attempting to mix oil and water. I have nothing but the deepest admiration for the work done in Malta, and I have followed the progress of the investigation with the keenest interest; though you may not credit me, I have culled a good deal of it from the labyrinth of the unfortunate numerical + and − monkeys (not without travail of soul, however), and much of it from the pages of the Journal. Curiously enough, in the number before me, there is a very lucid paper—if you will permit me to say so—on this very subject, which lends strong support to the argument I advanced, viz., that non-experts hunger for results and not for too much detail. The title of the paper is "Recent Researches into the Epidemiology of Malta Fever," it was read before the Epidemiological Society by one Colonel David Bruce, C.B., F.R.S., D.Sc., and I can confidently commend it to your careful perusal.

"The main function of this Journal is to assist in the development of the Army Medical Service into a scientific Corps, by which a large part of the scientific medical work of the Empire would be done." Thus you wrote in 1904, and the ambition is sufficiently laudable. But, I recollect well that I demurred then, as I do now, and that for two reasons: first, that the words imply that hitherto it had not been a scientific Corps, the which I submit is an unwarrantable assumption capable of ample refutation, and secondly, that whilst admitting that scientific development is one of its functions, it by no means follows that it is the only one, nor within the range of practical politics. Contrariwise, I think it is impossible and probably not desirable to conduct it on purely scientific lines, for there are other journals already existent better suited to this object and commanding a far wider *clientèle*, which our Journal can never hope to emulate, now or hereafter. As Counsel would say, I suggest to you that when you wrote "scientific" you really meant "bacteriological," and the context of that editorial, if my memory does not play me false, gives colour to that suggestion. If so, it but accentuates the situation, for I think there is danger ahead from narrowness of policy, which, if not guarded against betimes, may well mean ultimate disaster. No, Sir, the functions of the Royal Army Medical Corps Journal are, or should be, manifold, embracing everything pertaining to the Corps, directly or indirectly, fostering it, mothering it, struggling for it, not giving undue

prominence to any one part of our work, but recognising that every part —administrative, scientific, clinical, therapeutic, reformative, everything—have all their proper place. Fortunately, as you say, the Journal is what our officers make it, and signs are not wanting that the perspective is widening.

Human nature is human nature all the world over. You have your pet "ism," around which (to you) the world revolves, I have mine, so have we all. Of course, it was national heresy on my part to write anything in humorous vein—there was always the waste-paper basket, however. I am by no means sure, though, that in ridicule we do not possess a very potent weapon wherewith to combat "stupidity," for it is of the very essence of that attribute to ignore scientific investigation, no matter how conclusive, whilst it will respond readily enough to the shaft of satire. Moreover, in the case at issue, I was not ridiculing inaction on points which are still scientifically *sub judice*—that would be both futile and foolish—but I was referring to matters of everyday common sense. We do not require scientific investigation, for instance, to teach us that a dry-earth latrine within a dozen yards of a cookhouse is not sanitary salvation. Nor have I any wish to belittle bacteriology; it is a grand science, and the possibilities before it are dazzling; personally, I think that now, in its adolescence, it is doing for clinical and preventive medicine what it did for surgery in its infancy, but that is far from admitting that it is the be-all and end-all of scientific medicine. Prevention is indubitably the goal we strive for, but we must not forget that this millennium is still very much *in posse*, and consequently be led into the serious error of neglecting the *in esse;* nor is it seemly, in pursuit of our individual "isms," to wax contemptuous of the work of other labourers in the vineyard, if for no higher reason than the fact that the retort *ignoramus ignorabimus* is so very obvious.

In conclusion, permit me to tell you a little story. As a Scotsman, you are well aware of the Presbyterian puritanism which is so prevalent in our native land—perhaps not so much now as in the days of our boyhood. The story goes that a Free Kirk Elder, observing a brother Elder taking a "constitutional" on Sunday, was moved to remonstrance. "Mr. McQueen," said he, "I'm astonished to see siccan a backsliding, walkin' on the Sāwbath day." To which he received the startling and staggering reply: "Mr. McTavish, I div' not see ony harm ava in walkin' on the Sāwbath, and moreover, I'm thinkin' *verra seriously* of introducin' an occāsional dāmn into ma conversātion." History does not relate what was the effect on Elder McTavish, but I think the moral deduction for us is obvious. I put it to you, Sir, that *possibly* there are other things greater and grander even than preventive medicine, and *that* in face of the triumphant outcome of the Malta Commission.

> "So careful of the type she seems,
> So careless of the single life,"

is a couplet which occurs to me as pointing that moral, for we cannot

deny that even the *Micrococcus melitensis* is a type—but I am trending towards my own pet "ism," and that has nothing to do with the subject. In all humility I would suggest that the moral is contained in one word, "tolerance," a word which trips glibly from the tongues of most, but which is but too often belied by our actions. Perchance, though, some of us may not be too old to lay a good lesson to heart, and if we cannot go quite so far as a descent into the arena, we may still recognise the fact, that the intrdouction of "an occasional damn into the conversation," is not necessarily valueless. *Quot homines, tot sententiæ* may be accepted as a truism, but all the same it has its limitations.

Yours faithfully,

R. H. Forman,

Colonel, R.A.M.C.

Bombay,

March 26*th*, 1907.

ROYAL ARMY MEDICAL COLLEGE: AN APPEAL.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

My dear Colonel,—May I ask you to be good enough to find a corner in the Journal for the following appeal?

As the Royal Army Medical College will shortly be opened, this seems to be an appropriate moment to bring before my brother officers a want which becomes more and more acute; this is, that there is no properly organised department of the Pathological Museum devoted to the collection, identification and classification of the biting flies, insects and other parasites, which play such a large part in the transmission of disease, and especially of the tropical diseases to which the soldier is so liable.

It has long been my wish to organise such a department, and thanks to the kindness of some of my brother officers, I have already the nucleus of a collection. In our cramped and temporary home on the Embankment there was no room to expand in this direction, but this excuse is no longer available, and in our new College there will be ample accommodation.

The need of such a collection requires no advocacy from me, and I am well aware that many have felt its absence to be a handicap to the advancement of research in tropical pathology. A type collection of mosquitoes, ticks, and other parasites of man, would be of the greatest use to all who are working, either to qualify themselves for original research in the tropics, or for the purpose of obtaining a diploma of tropical medicine.

With our large and widely-distributed Corps it should be a matter of little difficulty to start such a collection, if only the co-operation of a few officers in each country could be obtained, and once started, I have little

doubt that, in a short time, we should be in the possession of one of the best collections of the country.

My appeal, then, is that any who may, in this way, be willing to work for the general good, should make a collection of the biting flies and insects which are to be found in their districts and forward them to me at the new College, Millbank. For my own part, I should be extremely grateful for all that may be sent, and, if it is in my power to be of any service in the way of identifying, or getting identified, particular species, or in forwarding information as to the best means of collection and transport, I need hardly say it will give me the greatest pleasure. If the response to this appeal is as large as I trust it will be, many duplicates will doubtless be received, but such will by no means be wasted, since they will be most useful for demonstration purposes in the various classes of pathology.

If those who are willing to help will be good enough to communicate with me, I will give them further particulars as to what is specially required, and, if desired, will be glad to send them such equipment as may be necessary for the mounting and dispatch of the specimens.

Pathological Laboratory,
Royal Army Medical College.
April 18th, 1907.

Very sincerely yours,
W. B. LEISHMAN.

VOLUME VIII. JUNE, 1907. No. 6

Journal

of the

Royal Army Medical Corps.

Original Communications.

SOME ORIGINAL OBSERVATIONS ON RESPIRATORY-PULSE CURVES AND VENOUS PULSE IN HEALTHY PEOPLE.

By LIEUTENANT-COLONEL H. E. DEANE.
Royal Army Medical Corps (R.).

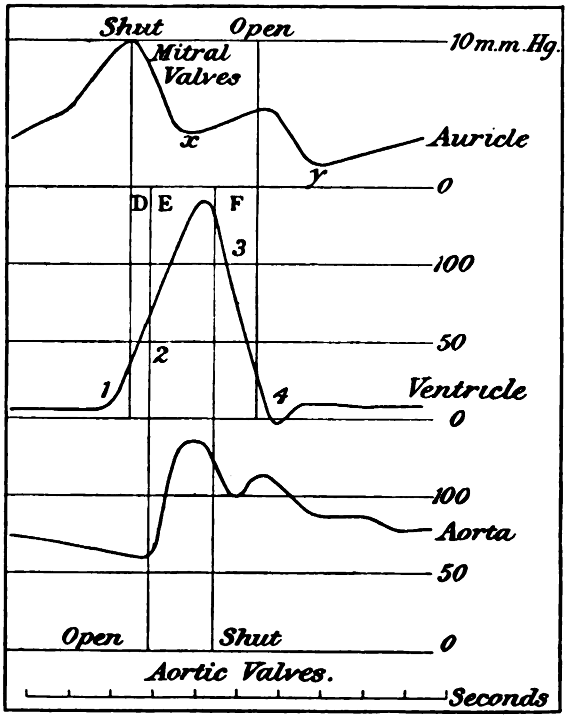
(Continued from p. 514).

I DEFER recording observations regarding the effect on the pulse of holding the breath, and of straining, as it is necessary to show considerable lengths of tracings, which cannot be done here.

During my observations on a non-commissioned officer of the Gymnastic Class at Aldershot, who frequently exhibited a pulsus paradoxus and whose tracing has been already given, I found he had a venous pulse in the right jugular vein. I then tried his comrades in the same squad, and found they had it too, and on continuing the observations I found it an exceptional thing not to get one. I then extended my observations further afield, and in this paper I give illustrations of the results.

References to a venous pulse in the normal individual in text-books on physiology are either absent or very meagre, and also in text-books on clinical medicine, and in none of them is any explanation or analysis of the pulse curve given. A full analysis of the venous pulse and its variations is given by Dr. James Mackenzie in his "Study of the Pulse," and by his kind permission I reproduce the diagram of a cardiac cycle from the book and his description thereof, in order to make the explanation of the venous-pulse curve

clear. I may say that all the tracings were taken from the right internal jugular, by means of Mackenzie's tambour attachment to a Dudgeon's sphygmograph.



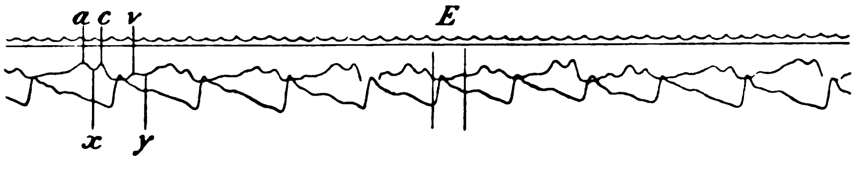
D, Presphygmic interval during which there is a forward movement of apex of heart while ventricle begins to contract. The pressure in the ventricle rapidly rising, the mitral valves close as soon as pressure in the ventricle exceeds that in the auricle. As soon as pressure in the ventricle exceeds that in the aorta, the semilunar valves open; this occurs at end of period (D).

E, Period of ventricular outflow.

F, Period of relaxation of ventricular muscle; a postsphygmic interval—the ventricular pressure is rapidly falling, and when below that in the auricles, the auriculo-ventricular valves open.

There are two rises in the auricular-pressure curve—a large one and a small one, with two falls. The first rise in pressure immediately precedes the rise in ventricular pressure due to systole of the auricle. When the auricle ceases to contract a fall (x) occurs, due to diastole of the auricle. The mitral valves are closed, and the blood pouring into the auricle from the veins, the pressure gradually rises, producing the second small wave in the curve. This wave is terminated by the opening of the auriculo-ventricular valves at the beginning of ventricular diastole—auricular pressure rises during the postsphygmic interval (F). When the pressure in the ventricles becomes lower than that in the auricles, the valves open, the blood passes through, auricular pressure is reduced, causing the second fall (Y). Then the pressure slowly rises in both auricles and ventricles till it is suddenly increased by the next auricular systole.

Now take the following tracing of a venous pulse from one of my cases in a healthy man :—

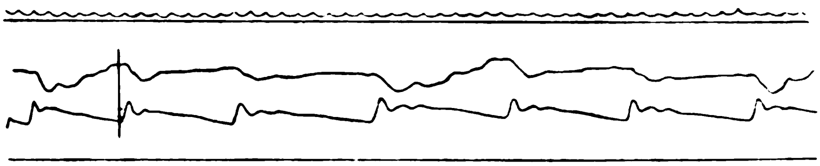


There is a large wave (A) preceding the period (E), which corresponds with the large wave in the diagram; then comes a fall (X), due to the auricular diastole, which fall is interrupted by another rise (C), due to the carotid pulse, after which the fall continues, and is followed by a gradual rise (V), corresponding with small curve in diagram, continuing after (E) till auriculo-ventricular valves open, when a fall (Y) occurs, interrupted by the next auricular systolic wave (A).

The wave (V) is due to increased pressure in the auricle, owing to blood flowing in from the veins; and this curve becomes modified in cases of tricuspid incompetence, appearing earlier in the cardiac cycle the greater the incompetence; for this reason Mackenzie calls it the ventricular wave, thus dividing a venous pulse into two types—auricular and ventricular. The latter being a morbid condition, and these present observations dealing only with normal pulses and hearts in which the valves are sound, no further reference will be made to it now, nor to the morbid states in which the auricular type of venous pulse occurs, and which are dealt with by Mackenzie.

It has been supposed that the presence of a venous pulse in a healthy man is indicative of a weakness of the circulation, which would not stand a stress of exertion; and that the heart would not respond so kindly to varying conditions as in the case of non-existence of venous pulse.

I think more extended observations on different classes of healthy people will not bear out that opinion. I have had a difficulty since commencing these observations in finding anyone without it, and, moreover, in a well-marked form; that is, supposing the amplitude of the venous-pulse curves present any criterion, which is a point requiring further investigation. To illustrate this point I give two tracings (Tracings 25 and 26), showing a marked difference in the amplitude of the venous curves; Tracing



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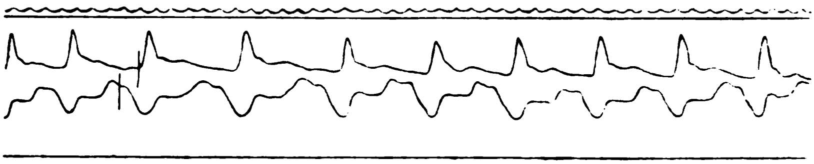

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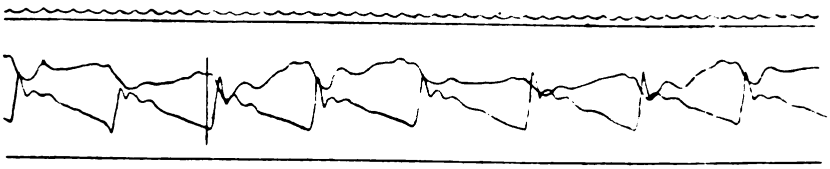

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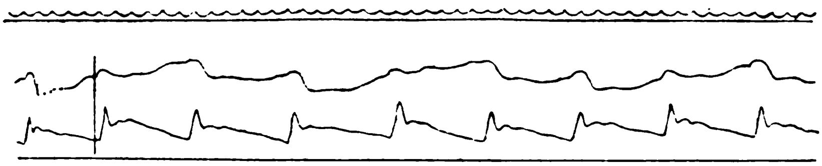

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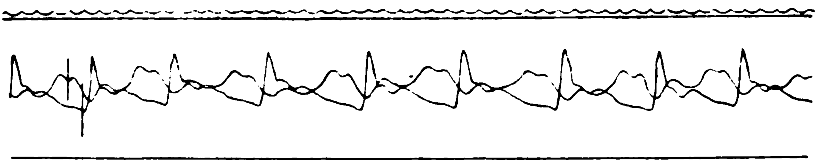

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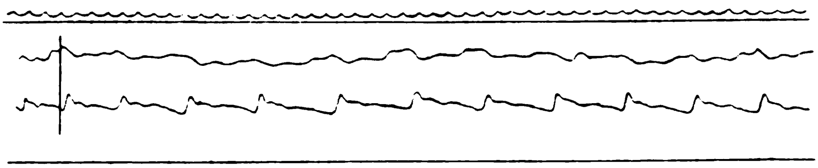

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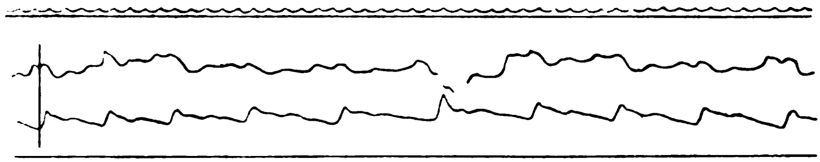

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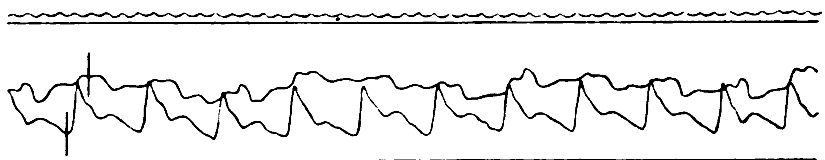

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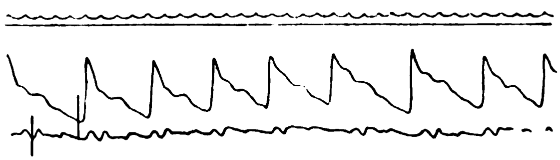

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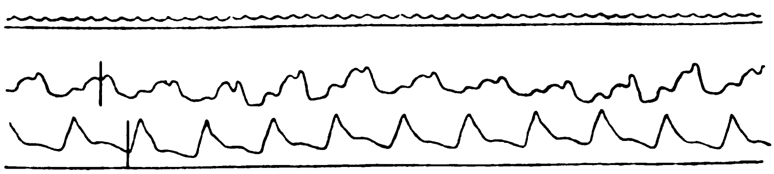

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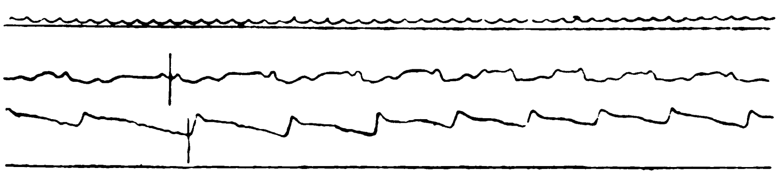

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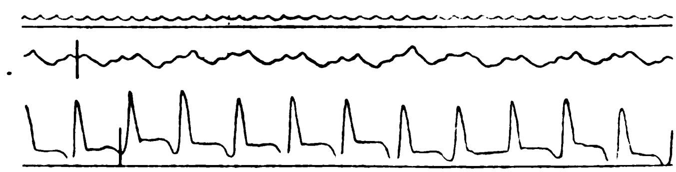
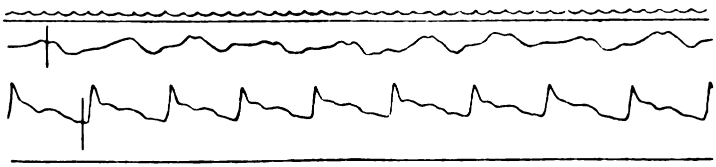


TRACING No. 36.

25 is of an officer, a powerful man, a Superintendent of Gymnasia, winner of the middle-weight boxing championship of the Army, and who plays "forward" in the London Scottish football team. I mention these facts, and similar ones in connection with other examples, to show that the presence of a venous pulse does not mean that the cardiac response is feeble, or that the subjects thereof are liable to breathlessness on exertion. On the contrary, it will be evident that the men whose tracings of venous pulse I give in this paper are good-winded and capable of hard and prolonged exertion without any distress. Tracing 26 is of a powerful bombardier who was going through the Gymnastic Instructors' Course at Aldershot.



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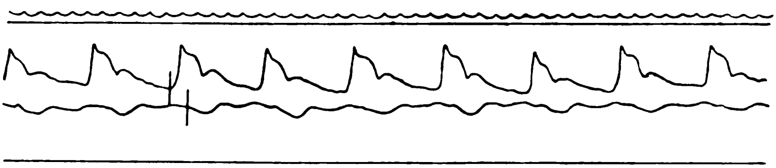

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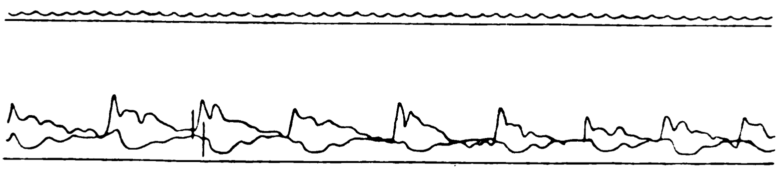


TRACING No. 39.

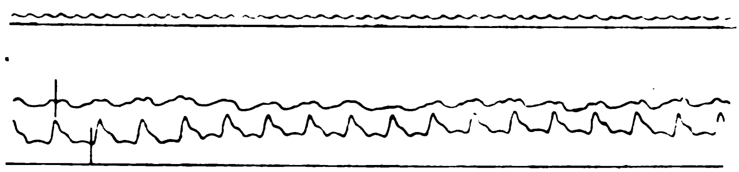
I will give examples of the tracings that I have obtained from various people.

Tracing 27 is of Lieutenant and Master-at-Arms J. Betts, Army Gymnastic Staff, winner of thirty-three medals at military tournaments.

Tracing 28 is of Tom Burrows, champion club swinger of the world, and was taken at Edinburgh the day following his swinging clubs twelve hours a day for six consecutive days.

Tracing 29 is of Company-Sergeant-Major Dent, Army Gymnastic Staff, who, in addition to his gymnastic work, is boxing instructor to the 21st Lancers.

Tracings 30, 31, 32, are of non-commissioned officers who were in the Gymnastic Instructors' Class. The man from whom Tracing 30 was taken had previousiy served twelve years in a band, and it would be so easy to conclude that the fact of his playing wind instruments accounted for his venous pulse; but the other men had not so served.



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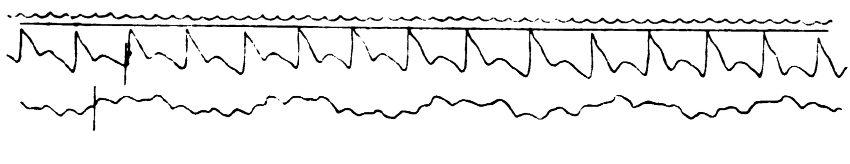

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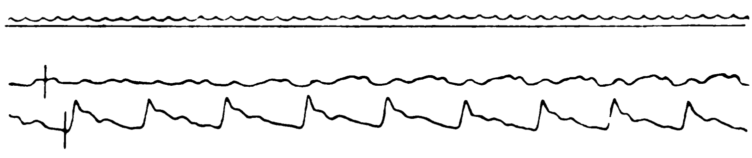


TRACING No. 42.

Tracing 33 is of a recruit of three months' service.

Tracing 34 is of a medical student.

Tracing 35 is of Lieutenant Langkilte, a retired officer of the Danish Army, attached temporarily to the Aldershot Gymnasium as Instructor of Gymnastics.

Tracings 36, 37, are of two lady gymnasts trained on the Swedish system. These last three tracings show that the venous pulse has nothing to do with any particular kind of physical training.

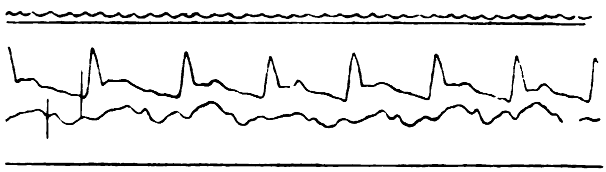
Tracings 38, 39, are of two ladies who have had no physical training at all.

By kind permission of Sir Alfred Keogh, K.C.B., Director-General,

Army Medical Service, I went to Netley to make some observations on men invalided for "disordered action of the heart." All the men I saw at different visits had the auricular type of venous pulse, but I can only give a few examples.

Tracings 40, 41, 42, are such.

In order to further illustrate that the venous pulse, in itself, has no essential connection with the cardiac condition of these men, I



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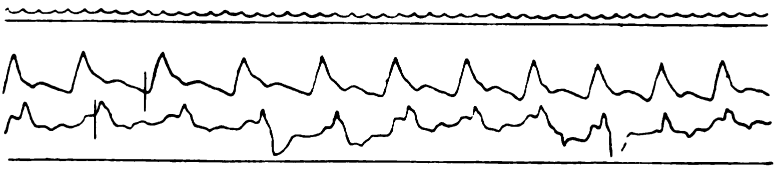

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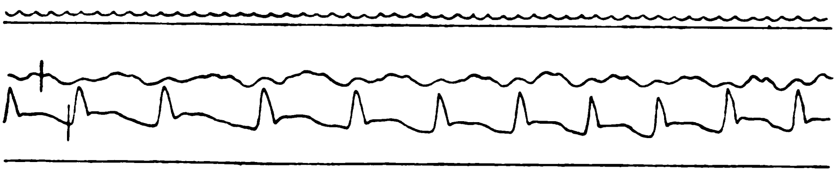

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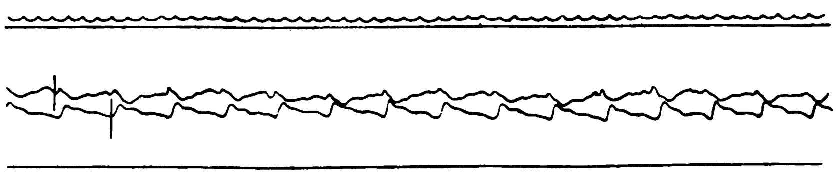
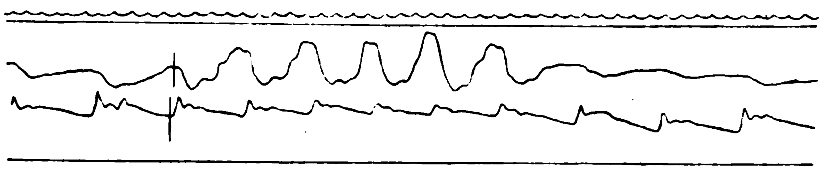


TRACING No. 46.

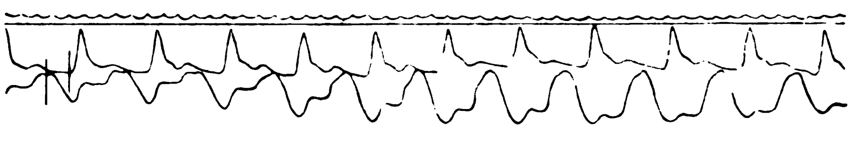
made observations on a medical officer doing duty in the Medical Division of the Hospital, on the Ward-master, and on patients in the Surgical Division, and they all had a venous pulse. Tracing 43 is of the medical officer mentioned. Also, by kind permission of the Director-General, I made observations on recruits for enlistment at St. George's Barracks, and it was exceptional to find one without a venous pulse. Tracings 44, 45, 46, are examples, the men being respectively a clerk, printer, and a motor driver.

I do not propose in this paper to refer to any changes in the venous-pulse curves, due to respiratory changes, in cases of disordered action of the heart, but to changes occurring in normal hearts during deep respiration. During a deep inspiration the amplitude of the venous curve becomes increased, at times greatly so.

Tracings 47, 48, 49, 50, are illustrations. Tracing 48 shows the inspiratory curve, and 49 the expiratory curve of the same man.



TRACING NO. 47.



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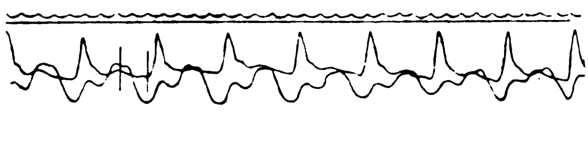

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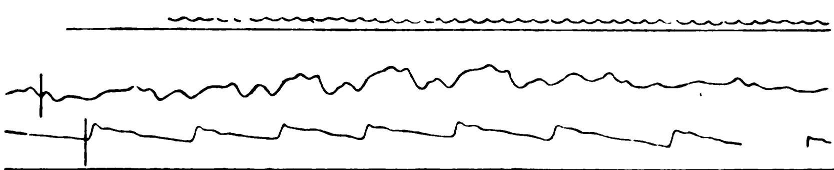

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The significance of these changes is not clear and they require further study, and I defer consideration of them to a future occasion. The importance of ascertaining what happens in the healthy individual cannot be over-estimated. Conditions which are noticed first in an unhealthy man are liable and, indeed, almost certain to lead to faulty conclusions.

We hear a good deal nowadays about the respiratory treatment of chest diseases, when the effects of deep respiration require further study first on healthy people under natural conditions of work and play.

THE NEW METHOD OF DETECTING LATENT SYPHILIS.

By Lieutenant-Colonel C. BIRT.
Royal Army Medical Corps.

If we bleed a guinea-pig and mix some of its serum with the red blood corpuscles of a rabbit, these cells undergo no alteration. Inject this guinea-pig with the red blood corpuscles of a rabbit on three or four occasions at ten-day intervals; the serum of this animal will now have the property of laking the red blood corpuscles of a rabbit, that is, of causing them to part with their hæmoglobin.

The serum of this guinea-pig which has received subcutaneous injections of rabbit's blood is found to consist of two constituents:—

No. 1 *Substance.*—Alexin, also known as cytase or complement. This is destroyed by heating the serum at 55° C. for half an hour. It is not specific and is present in the blood of any animal.

No. 2 *Substance.*—Sensibilisatrice, also known as "fixateur," "amboceptor," "immune body," or "anti-body." It withstands heating at 55° C. for half an hour, by which it is freed from the No. 1 substance, or alexin, present with it. This No. 2 substance is strictly specific, and has the peculiar property of being absorbed by the red blood corpuscles of a rabbit and by none other.

Hence to cause the dissolution of the rabbit's red blood corpuscles we require (*a*) No. 1 substance, or alexin, which may be derived from the blood of a normal rabbit, or guinea-pig, or from any other animal, including man; (*b*) No. 2 substance, or sensibilisatrice, or "anti-body," which can only be obtained from the blood of another species of animal after its inoculation with rabbit's red blood corpuscles. Hæmolysis will not occur if only one of these constituents be present. Thus rabbit's blood mixed with human serum which contains No. 1 substance, or alexin, but no No. 2 substance, remains unchanged; no laking is produced. Also rabbit's red blood corpuscles mixed with No. 2 substance, or "anti-body" alone, retain their hæmoglobin, but the corpuscles absorb the "anti-body," readily, and in this condition, when added to any fluid containing No. 1 substance, or alexin, rapidly undergo hæmolysis and at the same time use up No. 1 substance, or alexin, in the process. We are, therefore, now in possession of a reagent, namely, these specially prepared rabbit red blood corpuscles, which

will detect the presence or absence of No. 1. substance, or alexin, in a fluid. They may be called "sensitive corpuscles."

We then proceed to another experiment. The blood of a normal guinea-pig has little effect on cholera vibrios. Inject this animal with an emulsion of this microbe on three or four occasions, at ten-day intervals. We shall thus obtain a serum which has the power of converting into granules and destroying cholera vibrios. As before, we analyse this serum and find that it is composed of two constituents:—

No. 1 *Substance.*—Alexin, cytase, or complement, destroyed by heating at 55° C. for half an hour; not specific—that is, it is contained in the blood of any animal.

No. 2 *Substance.*—Sensibilisatrice, also known as "fixateur," "amboceptor," "immune body," or "anti-body," which resists heating to 55° C. for half an hour. Any of the No. 1 substance which may have been present with it is thus eliminated. This No. 2 substance, or "anti-body," is strictly specific, and can only be obtained from an animal immunised with the cholera vibrio. It has the property of being absorbed by this microbe and by no other organism.

Destruction of the cholera vibrios does not occur if only one of the above constituents be present in a serum, but when the cholera commas are suspended in a fluid containing No. 2 substance, or cholera "anti-body," alone, they readily absorb it, and are then in a condition to take up No. 1 substance, or alexin, from any fluid to which they may be added. Add them to such a liquid. The vibrios are seen to undergo destructive changes. At the same time the No. 1 substance, or alexin, disappears. The disappearance of this No. 1 substance, or alexin, is therefore an index of the destruction of the vibrios. We can accordingly ascertain without the aid of the microscope whether transformation of the cholera vibrio has taken place or not, by testing the mixture for the absence or presence of No. 1 substance, or alexin. If No. 1 substance is found, the vibrios are unchanged. If No. 1 substance is absent, the vibrios are destroyed.

But we have already prepared a reagent for the detection of No. 1 substance, or alexin, namely, the "sensitive" red blood corpuscles of the rabbit. These remain unchanged if the No. 1 substance, or alexin, has vanished, but part with their hæmoglobin if alexin be free. We are now in a position to test the properties of an unknown serum. For example, we are called upon to determine whether a certain serum contains cholera No. 2 substance,

or cholera "anti-body." We first heat the serum to 55° C. for half an hour to destroy any No. 1 substance, or alexin, it may contain. We introduce cholera vibrios, and after a time a known quantity of No. 1 substance, or alexin, derived from the fresh blood of any normal animal. If the cholera No. 2 substance, or "anti-body," be present, the No. 1 substance, or alexin, will be consumed, and its absence recognised by the addition to the mixture of "sensitive" blood cells, our alexin detecter. If these remain undissolved, alexin is absent. We then know that the alexin we added has been used by the cholera vibrios. This is possible only through the intervention of cholera No. 2 substance, or "anti-body," which, therefore, was present in the unknown serum. The principle portrayed is universal. A microbe in conjunction with its No. 2 substance, or "anti-body," specific to itself, takes up and fixes No. 1 substance, or alexin.

By this procedure we have accomplished means by which a specific No. 2 substance, or "anti-body," can be demonstrated. The method will strike the reader as being extremely ingenious. Bordet and Gengou[1] were the talented experimenters who first devised it, and it is usually called their "alexin-fixation reaction." It has been widely adopted, and has proved of great value and exactness in the detection of specific No. 2 substances, or "anti-bodies," in many infections, such as plague, typhoid and paratyphoid fevers, dysentery, and notably in tubercle and gonorrhœa. By a modification of it, it is possible to determine the presence of traces of blood so minute as to escape notice altogether by other tests, however delicate.

We will now apply our knowledge to the diagnosis of syphilis. From the foregoing it is obvious that in a mixture containing the following in suitable proportions: No. 1 substance, or alexin; No. 2 substance, or "anti-body," specific for the *Spirochæta pallida;* No. 3, *S. pallida;* the alexin will be combined with the *S. pallida* through the intervention of the No. 2 substance, or syphilitic "anti-body." On utilising our alexin test—"sensitive blood corpuscles"—no alexin will be discovered—that is, the "sensitive cells" will remain unchanged; their hæmoglobin will not be discharged. If the No. 2 substance, or syphilitic serum, in the above mixture be replaced by normal serum, the alexin will remain free, since the *S. pallida* is unable to combine with it through the absence of specific No. 2 substance, or syphilitic "anti-body."

[1] J. Bordet et O. Gengou, *Annales de l'Institut Pasteur*, May, 1901, p. 289.

Hæmolysis of the "sensitive" blood cells will therefore result on adding our alexin reagent. So by the addition of *S. pallida* and No. 1 substance, or alexin, to an unknown serum, we can discover whether the specific No. 2 substance, or syphilitic "anti-body," is contained in that serum. Also it is plain that if the *S. pallida* be absent in the above mixture, the alexin will have nothing on which to fix itself and will remain free. If, then, to an unknown secretion, or exudation, we add in proper proportions (*a*) No. 1 substance, or alexin, and (*b*) specific No. 2 substance, or "anti-body," namely, syphilitic serum, we discover the presence of the *S. pallida* in that secretion or exudation by the alexin becoming fixed. Its disappearance is put in evidence by the alexin test. The "sensitive" blood cells remain unaffected.

The details of the technique adopted by Marie and Levaditi,[1] the latest experimenters, are here given. To prepare their "sensitive" red blood corpuscles, or "alexin test," they gave several injections of sheep's blood to rabbits. After some weeks they bled them and heated the serum at 56° C. for half an hour. This gave them their No. 2 substance, or "anti-body," specific for sheep's red blood corpuscles. Sheep's red blood corpuscles were washed in physiological salt solution and made with it into a 5 per cent. emulsion. This emulsion was treated with No. 2 substance, or sheep's blood "anti-body." The sheep's blood corpuscles were thus rendered "sensitive," and were now their "alexin detecter." For No. 1 substance, or alexin, they used fresh guinea-pig's blood serum.

Since it is impossible to obtain cultures of *S. pallida*, emulsions of liver and spleen of infants which had succumbed to hereditary syphilis were used. These viscera were proved, microscopically, to be rich in *S. pallida*, and were then finally minced and emulsified in physiological salt solution, 20 grammes in 100 cc., and 0·5 per cent. phenol added. The supernatant fluid, after centrifuging, was used as the emulsion of *S. pallida*. The source of their specific No. 2 substance, or syphilitic "anti-body," was the serum of a patient suffering from secondaries, or of a baboon which had received inoculations of syphilitic virus.

This is the detail of one of Marie and Levaditi's experiments, by which they demonstrated the presence of syphilitic No. 2 substance, or "anti-body," in the cerebro-spinal fluid of a general paralytic.

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[1] Marie and Levaditi, *Annales de l'Institut Pasteur*, February, 1907, p. 138.

They mixed :—

(1) 0·1 cc. of fresh guinea-pig's blood serum—No. 1 substance, or alexin.

(2) 1 cc. of cerebro-spinal fluid suspected to contain syphilitic "anti-body."

(3) 0·1 cc. of liver extract—*S. pallida* emulsion.

The mixture was incubated at 36° C. for two hours. They then employed their alexin detecter, which was prepared by mixing :—

(1) 0·1 cc. sheep's blood—No. 2 substance, or "anti-body."

(2) 1 cc. of 5 per cent. emulsion of washed sheep's red blood corpuscles.

This mixture was added to the first and the whole incubated for one hour at 36° C. No hæmolysis was observed. This proved that the alexin they had added had disappeared. This disappearance could only be rendered possible by the *S. pallida* fixing it through the intervention of No. 2 substance, or "anti-body," specific for the Spirochæta, contained in the cerebro-spinal fluid. They controlled their results by observing complete hæmolysis—that is, presence of free alexin, when they employed the fresh guinea-pig's blood serum and cerebro-spinal fluid only, without any liver extract, and when they mixed guinea-pig's blood serum and liver extract without any cerebro-spinal fluid. Moreover, they proved that the reaction was negative—that is, the alexin was not fixed—when they substituted normal infant's, in place of the Spirochæta-containing, liver, and when they made use of normal cerebro-spinal fluid instead of that derived from syphilitics or paralytics.

The following are abstracts of all observations published up to the present time.

Neisser, Bruck and Schucht[1] examined 163 persons presenting symptoms of active syphilis, and by means of Bordet-Gengou "alexin-fixation reaction," proved the existence of the *S. pallida* in exudations or discharges from, or the syphilitic "anti-bodies" in, the blood serum of 70 per cent. In 58 per cent. of ninty-nine syphilitic patients who bore no signs of the disease at the time of examination the results were positive.

Wassermann and Plaut[2] investigated the cerebro-spinal fluid of forty-one general paralytics and detected the syphilitic "anti-bodies" in 88 per cent. The reaction quite failed when the cerebro-spinal

[1] Neisser, Bruck et Schucht, *Deutsche Med. Woch.*, November 29th, 1906, p. 1937.

[2] A. Wassermann et F. Plaut, *Deustche Med. Woch.*, November 1st, 1906, p. 1769.

fluid of twenty-two other persons were used as controls. The latter list included some cases of cerebro-spinal meningitis. They showed that the cerebro-spinal fluid of the general paralytics was richer in the "anti-body" than the serum of the same patients. They inferred that this excess was caused by the local invasion of the *S. pallida* on the cerebro-spinal nervous system. Marie and Levaditi have confirmed Wassermann and Plaut's researches. They discovered the syphilitic "anti-body" in the cerebro-spinal fluid in 73 per cent. of thirty-nine general paralytics, and in 66 per cent. of the cases of tabes examined.

L. Detre[1] found the syphilitic "anti-body" in the blood serum of two syphilitics. He also detected the presence of *S. pallida* in the liver, pancreas and discharges from condylomata.

It seems that this method of diagnosing latent syphilis can be adapted for use in the United Kingdom, where it is illegal to obtain a drop of blood from the ear of a rabbit or guinea-pig by the prick of a needle, but where we incur none of the penalties of the law if we thus vivisect ourselves. We should require a serum hæmolytic for human blood obtained by injecting washed red blood corpuscles of man into an animal on several occasions. The alexin test would then be composed of our own washed red cells, rendered "sensitive" by being treated with this serum. Our own fresh blood serum would provide us with the No. 1 substance, or alexin. The liver of a syphilitic fœtus rich in Spirochætæ, if desiccated, retains its properties for a long period, and would give us a convenient supply of Spirochæta virus. The serum of a patient in the active secondary stage would be the source of our specific No. 2 substance, or "anti-body."

It is universally agreed that the technique is difficult and must be controlled in every way, or fallacious conclusions may be reached. Moreover, as in most other laboratory procedures, positive results afford good grounds for positive opinions, but negative observations do not necessarily warrant us to express the contrary.

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[1] L. Detre, *Wien. Klin. Woch.*, May 24th, 1906, p. 619.

DIAPHRAGMATIC DRILL FOR THE IMPROVEMENT OF THE "WIND" AND GENERAL HEALTH.

By Major R. F. E. AUSTIN.
Royal Army Medical Corps.

Diaphragmatic inefficiency is a subject which has engaged the earnest attention of not a few eminent medical men, foremost amongst those of the present century being Keith, of the London Hospital. His writings show that the evil is the outcome of an improper use of the thorax, which is the inevitable consequence of habitually holding the body in a faulty position, either in standing or sitting. The diaphragm is dependent for the maintenance of its position upon three supports: (1) abdominal, (2) thoracic, and (3) costal. The *abdominal* support is supplied mainly by the abdominal muscles, which keep the viscera pressed within the concavities of the diaphragm. The *thoracic* support is provided by the pericardium, heart and other viscera, which directly or indirectly attach the upper surface of the diaphragm to the structures at the root of the neck and the whole extent of the thoracic wall. The *costal* support is given by the abdominal ends of the six lower ribs. A partial collapse of any one of these supports is followed by a corresponding failure of the other two. Putting aside the question of actual disease, it is obvious that as long as the body is habitually held in a natural position there will be no collapse of any of these supports. Should, however, circumstances, over which we may or may not have control, arise to upset the normal balance of the body, and a new centre of gravity become habitual, a corresponding weakening of the respiratory forces takes place, and sooner or later a vitiated method of breathing becomes firmly established.

Reference to some facts concerning the mechanism of respiration is now necessary, for as Keith very truly says, "the current teaching of physiological text-books is only partially true." *The thorax is not expanded in every diameter*, the apex and posterior wall of the thorax take no part in the enlargement of the chest; the expansion takes place only in a downward, forward and outward direction, necessitating the movement of the entire lung. The only movement which takes place in the spinal segment of a rib is one of pure rotation, a movement which cannot and does not help to enlarge the thorax. Indeed, in a full costal inspiration the spinal

segment of the lower ribs (with the exception of the twelfth) moves slightly forward, and thus somewhat diminishes the size of the thorax. The apex of the lung can only be efficiently expanded by the diaphragm; it cannot be expanded by raising the apex of the thorax. In fact, the more the apex of the thorax is raised, the less is the inspiratory power of the diaphragm; mere depression of the diaphragmatic surface to the extent of 1 cm. (a common occurrence in normal quiet inspiration) gives an increase to the pulmonary capacity of 250 cc., the amount of air inspired when an ordinary breath is taken. *Inspiration and expiration are controlled muscular acts.* The widely spread but erroneous idea that expiration is an elastic recoil, can be traced to Dr. Hutchinson's classical work published in 1835. Powell showed long ago that Hutchinson's conception of the elastic recoil of the ribs and cartilages as a cause of expiration was due to an error of observation, for they present no elastic resistance within the limits of normal respiration. As for the elasticity of the lungs, this factor plays only a passive part in expiration; as Keith very truly observes, were the whole expiratory movement caused by the elasticity of the lungs, everyone of us would suffer from emphysema in three months' time. So delicate is the elasticity of the lungs that artificial respiration quickly destroys it. The rate at which the lungs collapse during expiration is solely determined by the muscles of respiration. *The muscles of respiration:* there is no need to enumerate these; suffice it to say that Keith has shown that many of the muscles which were looked upon by physiologists as essentially respiratory in function are only synergic or fixing muscles, whilst the muscles of the abdominal walls which are usually included in the list of extraordinary muscles of respiration, are first and foremost muscles of ordinary respiration; in comparison their other functions are of minor import. The two actions of the diaphragm cannot be better described than in Keith's own words: "In man, as in mammals generally, were the contents of the abdominal cavity removed, the diaphragm, by drawing the costal margin inwards, would diminish the body cavity and thus act as a muscle of expiration. By the simple device of using the contents of the mammalian abdomen as a respiratory piston, the diaphragm becomes one of the chief muscles of inspiration. If the muscles of the abdominal wall offer a strenuous opposition to the descent of the viscera, then the abdominal contents are no longer a respiratory piston, but a respiratory fulcrum on which the diaphragm is supported and from which it exerts its force on the points of insertion,

the six lower ribs. By its contraction it tends to lift the whole thoracic cage off the abdominal fulcrum. The type of respiration is then said to be *thoracic.* If, on the other hand, the abdominal walls and viscera yield to the pressure of the diaphragm, then the force of its contraction is spent, not in lifting up the thoracic cage, but in forcing down the abdominal viscera, which becomes then a respiratory piston. The type of respiration is then said to be *abdominal.*"

The important part played by the belly muscles in these two types of respiration deserves some notice. In abdominal breathing during inspiration the epigastrium is protruded, whilst in expiration it is drawn in. The antero-posterior diameter of the whole thorax remains a constant factor; there is no rib movement whatever, except during unusually deep expiration, when the costal arches are drawn inwards. Most writers make the extraordinary statement that the diaphragm can be depressed and the ribs elevated at one and the same time. This, of course, is physically impossible. It is true the diaphragm can be first depressed and the ribs then raised, and *vice-versâ,* but these respiratory gymnastics are not to be confounded with true controlled abdominal breathing. In thoracic breathing the abdomen, or, to be more correct, the pit of the stomach, is drawn in during inspiration and is flattened again during expiration. The middle and lower portions of the chest are expanded, the increase of the diameter at the base of the thorax, where the ribs are very flexible, being especially noticeable. In the normal individual, that is to say, one whose lower ribs are freely mobile, the extreme upper portion of the chest, as we have already seen, remains quiescent, and for that reason this type of respiration is known to teachers as the lower costal mechanism. This, as a rule, is the method of breathing used by the runner. It may be of interest to note that the two types of respiration under discussion are sometimes known to teachers of voice production as the *high fixed chest methods of breathing.*

It will have been gathered that in normal respiration the thorax is expanded and contracted solely by the action of the muscles situated below the level of the clavicles; this mechanism ensures the adequate patency of the airway, at all times a most important point. Let us now glance at an unphysiological type, which, unfortunately, is all too common. I allude to that more or less audible, shallow, jerky and uncontrolled act known as the *clavicular* or *superior costal* method of breathing. In this mechanism the air is sucked in by raising the shoulders and contracting the muscles

of the neck, in other words, by bringing into greater or lesser action the so-called extraordinary muscles of respiration. A "sniff" or "gasp," that may or may not be very audible, which accompanies this act, plainly shows that the airway has been narrowed. The consequence of constricting the air channel at a time when it should be widely open, is, of course, to temporarily lower the air-pressure in the respiratory tract and produce a transient flushing of the vessels. The audible expiration due to partial closure of the glottis, reflexly brought about by the strain placed upon the muscles of the neck in holding up the upper part of the thorax, combined with the fact that the upper chest sinks in at a greater rate than the lower, owing to the inability of the cervical and other muscles to nicely regulate expiration, brings about a harmful increase of intra-pulmonary pressure. Setting aside the question of inadequate respiratory exchange and the other baneful effects inseparable from this mode of respiration, it can be readily seen that the harmful, lowering and excessive increase of the intra-pulmonary tension must, sooner or later, impair the vitality of the lung tissues, and the onset of pulmonary and other diseases then becomes merely a question of time. It should be clearly understood that the expiratory act during voice production—when properly controlled—does not bring about a harmful increase of intra-pulmonary pressure. But when the breathing is more or less uncontrolled the case is different. Expiration cannot be properly regulated when the superior costal type of respiration is the method in use. The harmful habit of taking breath with a "gasp" is an important agent in the production of hoarseness and vocal discomfort in public voice users and others. Clergyman's throat is a case in point. Under normal conditions the superior costal type of respiration is never seen in four-footed animals, neither is it found amongst anthropoid apes, or in the healthy human infant, and when it occurs in man it is not developed until after he has learnt to walk. Dr. Holbrook Curtis has collected statistics which show that this vitiated type of respiration, which is so marked a feature amongst women of civilised races, is largely the result of the corset and tight-lacing.

Keith has shown that there is a relationship between the mechanism of respiration and the incidence of pulmonary disease and abdominal displacements. Enteroptosis he places amongst the respiratory diseases. At what degree of displacement marked impairment of diaphragmatic action and disorganisation of the functions of the thorax and abdominal viscera takes place it is

difficult to define with exactitude, the physiological limits are so wide. The disease, he insists, must be judged, not by the extent of the displacement, but by the degree of distress. A word on the respiratory movements of the liver may not be uninteresting. This organ, as is well known, has no inherent motor power for pushing on its circulation, and is dependent upon adequate respiratory movements for the promotion of the circulation within itself. So, unless it is habitually squeezed between the diaphragm and abdominal muscles, hepatic congestion and its attendant evils sooner or later supervene. Riding and other means are often employed to produce abdominal activity, and as long as they are continued they offer a wonderful relief in cases of liver torpidity, but relapse in the exercises, &c., is only too often followed by a return of symptoms. By habitually using the abdominal muscles in breathing, our usual daily activities would, under reasonable circumstances, be sufficient to keep the liver in good working order.

We have seen that a faulty carriage of the body disorganises the respiratory mechanism, and this in turn leads to many pathological conditions. So it is evident the philosopher Delsarte was wonderfully near the mark when he made the assertion that "All our sufferings and sins are due to lack of poise, physical, mental, or spiritual. All that is in equilibrium is harmonised, and all harmonies occur in one same whole, in one same truth; in a word, all truths interpenetrate, and when a thing is true from one point of view it is so from all."

This is a fitting opportunity to refer to the question of breathlessness during muscular exercise and at other times. Respiratory distress, as Lagrange has shown, is the direct outcome of disorderly respiratory movements which destroy the regularity of respiratory exchange; respiratory need being unsatisfied, breathlessness comes on as a matter of course. The heart, it is true, takes a share in the production of the symptoms, for the movements of the heart and lungs are interdependent. The respiratory pump is of great assistance to the heart, as it furthers not only the return of venous blood but also the pulmonary circulation. That the functioning power of the heart is largely influenced by respiration is well shown in cases of heart failure from chloroform poisoning and in the apparently drowned: in neither instance can the circulation be re-established until the respiratory pump has been set to work. Then, again, the completeness or otherwise with which the respiratory act is carried out, in other words, the rate at which the movements take place, must and do have a great influence on the pulse. This

is well exemplified in nearly all diseased conditions when more or less hurried respiratory movements are followed by acceleration of the pulse. It is also worthy of note that after exercise respirations resume their average rate *before* the heart beats. A question which demands an answer will here suggest itself. What is the normal pulse and respiratory rate? Sixteen to nineteen respirations a minute are probably correct in unphysiological types. It would be interesting to know what the average number is in persons who habitually breathe properly, as many singers and speakers do. But I am digressing, and must return to my subject. A runner out of training, or even a well-trained one who is nervous or out of condition, often explains the loss of a race by the fact that he never got his "second wind," which in other words simply means that he never succeeded in getting his bellows to work properly, and in this connection the following excerpt from Dr. Harry Campbell's book on "Respiratory Exercises" is of interest: "When the mind is deeply absorbed the respiratory movements are inhibited, they may indeed be temporarily suspended, as, for instance, during the 'breathless attention' that awaits the announcement of some momentous news, or follows the course of an interesting narrative."

Lagrange says: "Breathlessness occurs when muscular work produces in a given time more carbonic acid in the blood than the lungs can eliminate in the same time. There exists for each individual a *coefficient* of breathlessness which varies with his respiratory fitness. The moment when breathlessness will occur will be retarded by the vigour of the subject, the size of his lungs, the perfect integrity of his heart, *and above all by his acquired aptitude in the use of the respiratory organs.* . . . We may say that the respiratory fitness of the individual is the true regulator of a work of endurance." In other words, a man has "staying power" when he has "wind." And the following passage from the late Surgeon-Captain Hooper Dixon's little book on "The Art of Breathing" is very much to the point: "A man goes in for fencing, boxing or running, and devotes his training to the muscles concerned in these respective exercises, irrespective of the diaphragm, and little dreams of the enormous benefit that may be derived from training his bellows and learning to control his wind."

We are now in a position to state that physiological or *silent controlled nasal respiration* is dependent upon perfect expansion and contraction of the middle and lower part of the chest, coupled with adequate dilatation of the nostrils and glottis—the pit of the

stomach is included in the expression "lower part of the chest." Whether the mechanism employed should be that of the abdominal or lower costal type, entirely depends upon the amount of air required at the time to supply the needs of the individual. Nature, if not hampered in some manner, will produce the most desirable form of breathing unaided.

It cannot be too strongly insisted on that unless the air is taken in through the nose the process of warming, moistening, and filtering cannot and does not take place. Dr. St. Clair Thomson and other eminent rhinologists have shown that the post-nasal space in a *healthy* nose is sterile, in fact, the nose is a great microbe trap and constitutes our first line of defence against air-borne organisms. It is therefore obvious that if germs are found in the mouth and throat of a presumably healthy individual, they have gained admittance through the mouth. I wish to lay particular stress upon this point, for very frequently individuals who *can* breathe through their nose quite easily labour under the delusion that they habitually do so. Indeed, many medical men with whom I have discussed this question, have repeatedly assured me that under ordinary circumstances they are never guilty of using the mouth as an airway, yet throughout the whole of our conversation they consistently ignored the nose, purely and simply because they were not breathing correctly. For, when this is done, the soft palate falls down over the root of the tongue and shuts off the mouth from the pharynx; on the other hand, if the breath is taken through the mouth the soft palate is raised and the naso-pharynx is more or less shut off. The mouth can be open and not a particle of air will be drawn into the lungs except through the nose, provided the soft palate is allowed to do its duty, and for this purpose there is no better exercise than the one given in Edwin Checkley's book on "Physical Training," namely, to practice dilating the nostrils as the horse does. It is perhaps needless for me to remark that habitual neglect of the nasal passages is an important agent in the production of an unhealthy condition of the mucous membrane, and also of that loss of tone in the muscles that dilate the nostrils which is such a marked feature in numberless persons. That the ability to breathe through the mouth is an acquired habit, is proved by the fact that an infant whose nose is held will almost suffocate.

Now for a consideration of the work to be done before it is possible to reinstate that condition which is the birthright of every normal child, and which has been lost either through the ignorance of those who brought us up, or, later in life, through our own

carelessness, fostered more often than not in ignorance also. The following are the points to be noticed: (1) Mental education. (2) Restoration of lost balance. (3) Development by drill and subsequent use.

Mental Education.—The mind must be trained to will aright, and, above all, what not to will. In other words, a clear mental impression of the respiratory act must be given. "Will is a blind power unless enlightened by reason or understanding. For one person who fails through want of ability there are thousands who fail through want of accurate mental training, for mind possesses, informs, and rules the body within its limit of change. These limits can be contracted by disuse—atrophy, still further contracted by abuse—distortion; and they can, on the other hand, be expanded by right use—development" (Lunn). As Mr. Barnard Bayliss, to whom I am indebted for a practical illustration of this psychological truth, very truly says, "The *mind* of the pupil is of first consideration. If *right* thinking be brought to bear upon the subject, the principles of Nature can be applied with wonderful success in otherwise quite hopeless cases. In the study of physiological breathing the following conditions will be noticed: The silence of respiration; the breath is taken in and expelled automatically, that is, the drawing in and expulsion of the breath is not consciously attempted, but results from certain bodily movements. In illustration of the above, as a whole, regarding breathing by movement, watch a cat asleep on a chair. The above method of procedure as regards breathing assists Nature by checking any unnatural effort, and affords breathing the greatest possibilities. At first the movements are brought about by mental effort, finally and before long they become automatic." As a sleeping cat is not always available I illustrate the idea to patients by comparing the action of the chest to a pair of bellows; the lower ribs, to which strong breathing muscles are attached, serve as handles. When the handles are drawn apart the air flows in, when they are closed the air is pressed out again; in other words, the lungs are passive agents, they simply follow the excursions of the chest wall. So all one has to do when practising is to centre the thoughts, not on the breathing, but on the expansion and contraction of the part of the body to which attention is specially directed in the drill. Then it is shown that "sniffing" and "gasping" are due to misdirected efforts to draw air in quickly by raising the shoulders, &c. The absurdity as well as the dangers of narrowing the airway at a time when it should be widely open is pointed out. It is then explained that if the

waist or chest is unduly constricted by belts, &c., or the body held in a rigid or unnatural position, their bellows is nearly as much embarrassed in its action as the ordinary kitchen article with its handles tied together. All undue efforts to obtain great expansion or contraction of the chest are discouraged; only absolutely correct controlled movements are necessary. No matter how small these are at first they will grow, until sooner or later normal development is reached, and the lungs can be noiselessly filled or emptied—that is, emptied as far as this is possible—in a moment if necessary. Further, it is pointed out that those who succeed in establishing a habit of breathing deeply during the day, breathe deeper even in sleep than the ordinary individual does, and in consequence live on a higher plane, physically, than those who do not. With regard to the question of lower rib breathing and abdominal breathing, the fact is mentioned that Nature will decide which is the most suitable under given circumstances; as a rule during more or less violent exercises lower rib breathing is the most advantageous, whilst abdominal would be chiefly employed at other times.

Restoration of the Lost Balance.—We have seen that the abdominal muscles are first and foremost muscles of ordinary respiration; it is also their duty to keep the viscera within the concavities of the diaphragm, thus providing a support for its undersurface. If the body is carelessly carried the chest falls, the abdominal support being to a certain extent withdrawn the diaphragm drops also, and its respiratory power is lessened, whilst the approximation of their attachments renders the abdominal muscles lax and weakens their respiratory action. When the body is carried *á la militaire*, with chest lifted high, back well hollowed, shoulders and hips drawn back, both the diaphragm and abdominal muscle are *kept* more or less on the stretch, so that full and free respiration is an impossibility. It should be remembered that when the scapulæ are well drawn back the serrati magni and other muscles covering the front of the thoracic cage become costal elevators, and as the lower ribs, unless compressed by stays, &c., are compelled to follow the upper ones, this necessitates an expansion of the lower bony chest; the more expanded this is, the nearer are the circumferential attachments of the diaphragm to the level of the central tendon, *i.e.*, the flatter is the diaphragm and the less is its inspiratory power. In spite of all that has been written and said against this preposterous chest poise, it is still in vogue. Certainly tradition dies hard in the Army.

A noticeable feature in very young children is the straightness of

the spine. Their backs are perfectly flat, and not until they begin to walk does a slight curve in the lumbar region develop. If the body is improperly carried this curve is unduly increased. Further, it should be observed that a healthy youngster, except when tired or developing lazy habits, rarely drops his head when he stoops down or sits, and under the circumstances the spine is never curved forward; the body is bent from the hips, knees and ankles.

The experience gained through numerous experiments led me to devise the following simple method for finding the normal body poise. Stand carelessly erect, head drooping forward, heels in line slightly apart, toes pointing outwards, arms hanging limply to the side. Rise on the toes and, keeping the shoulders passive, try to push the *crown* of the head upwards. If the movement is made correctly the chin is slightly drawn in so that the face is vertical, and parallel with the upright lines of the body, the back straightens, the chest rises, the shoulders find a comfortable centre and the abdomen recedes. Hold this position for a moment, then slowly lower the heels to the ground, the body will now be inclined slightly forward with the centre of gravity between the balls of the feet and heels. The ankle, hip and shoulder joints will be in one line. This pose, which is devoid of all stiffness or rigidity, should be habitually maintained when in the upright position. And in order that the "feeling" given by the position may be remembered, the instructions for finding it should be frequently carried out; this will be especially necessary whilst going through the respiratory exercises, for until this attitude has become, as it were, second nature, there is a tendency to settle down from it.

If we will but look after the head, the spine, chest, shoulders and abdomen will take care of themselves. "Draw the shoulders well back" is the worst possible advice that can be given to anyone, they should, instead, be told to reach their head (crown) up as high as possible with comfort, in order to "sit tall," "stand tall" and "walk tall." The baneful habit sometimes seriously recommended of always holding the abdomen drawn in as far as possible, cannot be too strongly condemned. The belly should be free to expand and contract; it should never be drawn in consciously except for respiratory and other purposes.

Diaphragmatic Drill.—It will be best to commence the drill lying down flat on the back with a pillow under the head sufficiently low to keep the face parallel with the front of the body. To ensure that the back is flat the knees should be drawn up until the soles of the feet rest on the floor. Control of the correct mechanism

will be obtained quicker by this means than if the practice were commenced standing. When the movements can be performed easily and at varying rates of speed in the supine position, then, and not till then, is it advisable to practise them in the upright posture.

Diaphragmatic Rib Action (*Lower Costal Breathing*).—On inspiration the nostrils dilate, the pit of the stomach is drawn in to prevent the descent of the diaphragm, and the lower and middle ribs move outwards. During expiration the ribs fall and the pit of the stomach resumes its former position.

To practice: Place the hands lightly over the lower ribs on each side of the costal arch, fingers pointing towards the pit of the stomach.

(1) Dilate the nostrils, at the same time draw in the pit of the stomach and expand the part of the chest covered by the hands.

(2) Hold the ribs out for three or four seconds.

(3) Steadily and without any jerk let the ribs fall.

Expire either through the nose or mouth, as fully as possible, without undue effort, then gently press the ribs in a little further with the hands and commence the next inspiration from this position. Repeat *ad. lib.*

The shoulders, collar bones, and apex of the thorax must remain quiescent; the greatest care must be taken to see that both expiration and inspiration are performed silently. Occasionally inhale through the nose with open mouth when practising in the upright position.

Diaphragmatic Abdominal Action (*Abdominal Breathing*).—The ribs remain stationary throughout. On inspiration the nostrils dilate and the pit of the stomach is pushed out. During expiration the pit of the stomach is drawn in.

To practice: Place one hand lightly across the front of the lower bony chest and the other over the pit of the stomach.

(1) Dilate the nostrils, at the same time push out the pit of the stomach a little—no movement should be felt under the hand across the chest.

(2) Hold the pit of the stomach out for three or four seconds.

(3) Steadily and without any jerk draw the pit of the stomach in.

Expire through the nose or mouth as fully as possible without undue effort, then gently press the pit of the stomach in a little further with the hand and commence the next inspiration from this position. Repeat *ad. lib.*

The shoulders, collar bones and ribs must remain quiescent. The greatest care must be taken to see that both expiration and

inspiration are performed silently. Occasionally inhale through the nose with open mouth when practising in the upright position.

Keith states that in true abdominal breathing the movement of the diaphragm is in a downward and forward direction, the posterior part descending more than the anterior. The more the fibres of the diaphragm tend to propel the viscera in a vertical direction the greater is the danger of visceral displacement. From this it will be gathered that it is harmful to a degree to practise great abdominal protrusion, more especially in a downward direction. It may be of interest to note in this connection that some teachers condemn abdominal breathing because it is considered unnatural. As we know, however, there is abdominal breathing *and* abdominal breathing. The discussions on this point arise chiefly from the fact that a vitiated type, where there is great protusion, especially below the umbilicus, is only too often brought forward as the correct type.

Taking them altogether, these exercises are most valuable, both in health and disease. They are essentially the same as some described by Dr. Harry Campbell, but I consider I have greatly enhanced their value by the addition of clearer instructions than is usually given, and above all by the dilating of the nostrils, a point of the greatest practical importance, upon which, as far as I am aware, all books of instruction, except Checkley's, are silent.

The aim of the training should be directed towards obtaining perfect control of the movements rather than to produce great expansion or contraction. By frequent use of the proper mechanism normal development will follow in due course and correct breathing will become an established habit.

In some instances, individuals who have got into the habit of keeping the shoulders well back, experience a difficulty at first when in the upright position in allowing the shoulders to find a comfortable centre, and so prevent the scapulæ affording *points d'appui* for the extraordinary costal elevators. In these cases it greatly assists matters to perform the respiratory exercises, for a time, with the body leaning well forward from the hips and the hands resting lightly against the back of a chair or table; this brings the scapulæ forward and renders passive the action of the serrati magni and other muscles which prevent the chest from assuming its normal poise. There are, of course, many other ways in which the same result can be brought about. Personally, I had to use a spirometer before I could get my expiratory muscles to overcome the tension of the extraordinary costal elevators.

A lesson we can learn from the lower animals is that the best

strength is that which is produced under natural habits. The lion keeps his marvellous strength without extraordinary effort, and so do the other beasts. Amongst the hardy uncivilised races—Zulus and Soudanese, for example—men and women of magnificent physique and great powers of endurance are as plentiful as blackberries, yet these individuals have not followed any system of physical training other than Nature's, which is the only kind that is lasting, or, as trainers say, "will stay put." The essence of the training consists in keeping the body free from artificial restraint, such as tight clothing; carrying the body correctly, so that the breathing is full and free, and thus giving the muscles and tissues in general opportunity to develop symmetry and strength from their ordinary use in daily life.

Seeing that it is our habits which form our bodies as well as our minds, and not spasmodic efforts at improvement, it would be interesting to know why it is considered necessary to make the soldier go through a course of muscle-building drill. More especially when it is remembered that muscles put on in this manner go to the bad again when the exercises that built them up are left off. A man cannot, unless he has lateral curvature of the spine or some other deformity, be taught to hold himself erect by crawling on his hands and knees, or laying on his back and kicking the air. Neither can he be taught to breathe correctly by practising unphysiological methods of expanding and contracting the chest; this can never be looked upon as a harmless amusement if it is borne in mind that departure from physiological conditions is the starting point of pathological states. The proper way to march, run, and breathe can only be learnt by practising these exercises, and the same procedure has to be adopted with other muscular movements that we wish to master.

If the soldier were taught to breathe correctly—this cannot be done if the body is hampered, as it is at present, by unsuitable clothing, which prevents a physiologically sound mode of carriage—and given plenty of walking and games, such as cricket, football, &c. (with moderation in food and drink), his physical condition would be as perfect as Nature intended it to be. Should, however, it be considered essential for some special reason that he must possess showy biceps and other muscles, care should be taken to prevent, as far as possible, the breath from being held during the muscle-moulding process, by counting, preferably in a loud whisper. The glottis is more open during a whispered tone than in ordinary speech.

It is a matter of common observation that, as a rule, officers look younger than non-commissioned officers and men of the same age. From personal examination of a large number I find that the respiratory powers are on the whole better in officers also, their thoraxes are more mobile, for one thing. I do not mean to imply that officers are perfect breathers, but there is no doubt that age for age they usually perform their respiratory duties in a more satisfactory manner than the men. The wearing of plain clothes has, I am convinced, a great deal to say to the matter. In our heart of hearts we all know that uniforms are not quite as comfortable as they should be, and the relief experienced on getting into mufti is not altogether an imaginary one. Many soldiers whom I have taught to breathe correctly when in hospital have confessed to me that in barracks they find it difficult to do so. For they must either hold themselves with shoulders well drawn back and the back more or less hollowed to fit their uniforms, or hold themselves carelessly, which is more often than not what they actually do. In either case it is not possible to use the abdominal muscles without a distinct effort. They, however, tell me that they have no difficulty in breathing freely and easily when in bed.

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[The foregoing article, "Diaphragmatic Drill for the Improvement of the 'Wind' and General Health," ought not to escape immediate criticism, for its appearance in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, will give it, in the eyes of medical and combatant officers alike, more support than it deserves.

The layman at the present time is so keenly interested in questions of health, diet and training, that it is the duty of the medical press to warn the uncritical reader of the dangers of the

numerous systems of physical education. Free and open criticism cannot fail to do good, for it will at least show how important it is to be guided by every-day experience and instinct, and it may encourage those of us who are determined to live our lives in freedom. There have always been men with a mission, who have sought to regulate the minds and bodies of their fellow-men according to some dogmatic system. At a time when we have great hopes of further mental freedom, we are assailed by a band of missionaries who would teach us how to breathe, how to avoid an excess of uric acid, how, by chewing, to reduce our need of proteid to one half, and how to develop our bodies and morals by the use of dumb-bells. No process of life is respected, nothing is sacred to these enthusiasts. Are there not even systems of eugenics?

No missionary can tell what one really thinks and believes, but it will be difficult to escape the keen eyes of the censors of our feeding and breathing. Is not a strong protest needed against this modern tendency? Young children are taken from the care of their mothers and are collected together into schools, where among other things they are taught breathing exercises. The chief results of this education of such young children have been severe epidemics of the infectious diseases to which children are liable, and the undermining of maternal instincts and responsibility.

Some of these remarks may be considered unnecessary; the blame must be attributed to the title of the paper. "Diaphragmatic Drill for the Improvement of the 'Wind' and General Health" calls up visions of other systems which have preceded it.

The article in question must be first attacked because it gives no evidence that diaphragmatic drill improves the "wind" and general health. It is not unreasonable to ask for the results of experiments, if there be any, to show that soldiers after a course of diaphragmatic drill can run better and are improved in general health. Such experiments should be accompanied by control experiments, to show that other factors, such as graduated practice, were not the essential ones.

The reader is told that "the mind must be trained to will aright, and above all what not to will; in other words, a clear mental impression of the respiratory act must be given." This is certainly unnecessary, for we are told that "amongst the hardy uncivilised races—Zulus and Soudanese, for example—men and women of magnificent physique and great powers of endurance are as plentiful as blackberries; yet these individuals have not followed any system of physical training other than Nature's, which is the only kind

that is lasting." This last sentence is sound teaching, and agrees with the best physiological work, which shows that respiration is self-regulated by changes in the composition of the blood and by unconscious nervous impulses.

Differences in the build of the body or the work of the individual will necessitate differences in the type of breathing; neither diaphragmatic drill nor a "clear mental impression of the respiratory act" can meet the changing requirements of the body. There is no evidence to show that breathing exercises are of the slightest value. The best way to improve the wind is the natural method recognised by all good trainers of men and horses, that is a course of graduated runs; "wind" involves both heart and lungs—most probably other organs as well—and it cannot be properly developed in any other way than by practice in the exercise for which the man is training.

Major Austin's paper contains many sound criticisms of the physical training in the Army, and an extension of these would have been of great value. Thousands of men in civil life do work which is as hard, or far harder, than that of soldiers; by the frequent practice of their work they train themselves. Who ever heard of a navvy training for his life's work by a course of gymnastics or breathing exercises? Where are the football players who train for the severe test of a Rugby match by any other method than the exercises involved in the game? A soldier can only be taught to march by marching, to run by running, to resist fatigue by experiencing fatigue, to breathe by breathing. The last is not a concession to diaphragmatic drill or any other so-called breathing exercise; breathing is strictly the intake of oxygen and the output of carbon dioxide. Muscular exercise increases the production of carbon dioxide, which, as Haldane and Priestley have shown, regulates the depth and frequency of the ventilation of the lungs. All kinds of muscular work, if properly graduated, will regulate unconsciously a man's breathing. The ventilation of the lungs is determined by the requirements of the body; the absorption of oxygen and the discharge of carbon dioxide cannot be regulated by "a clear mental impression of the respiratory act"—a third part at least of a man's life is spent in sleep.

M. S. PEMBREY.]

NOTES ON THE ORGANISATION AND METHODS OF THE MEDICAL SERVICE OF THE RUSSIAN ARMY IN TIME OF WAR.

By Major G. S. McLOUGHLIN, D.S.O.

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Sources of Information.—The following report is compiled from information kindly supplied to me (when in St. Petersburg in May and June, 1906) by officers of the General Staff and by the Headquarters Office of the Medical Service. The notes have been checked by the published works of M. Maksheef, Professor in the Nicolas Academy of the General Staff, and of M. Beloretsky; also by official tables, &c. These books are of recent date. The information has been obtained from authoritative sources and may be considered as correct in all important details. My personal thanks are especially due to Colonel d'Adabache and Captain Semenof, of the General Staff, for their kindness, more particularly to the latter for the courteous patience with which he devoted many hours to my instruction.

Explanatory and Prefatory Remarks.—In the Russian Army there is no medical corps; the surgeons are not officers, but hold grades of civil rank as officials. In medical establishments and units, therefore, duties of a military nature (for the execution of which the powers of an officer are required) are ordinarily carried out by specially appointed combatant officers. These officers belong to any combatant branch and receive no training for their temporary duties in medical establishments and units. The disadvantages of this system are obvious, but in Russia "officers are many and doctors few;" in view, therefore, of the conditions under which a campaign on a large scale must be carried on, there is an object in relieving, as far as possible, medical officials of duties which are not, in the narrowest sense, professional.

In these notes the term "surgeon" will, for convenience, be used to represent the Russian word *vrach*, whenever this occurs as the title of a medical official. From the standpoint of literal translation this is scarcely correct; the Russian word for surgeon, in the proper sense, is *chirurg*.

For the purpose of assisting the surgeons in their work a subordinate service of *feldshers*[1] exists. *Feldshers* are of two kinds,

[1] The word *feldsher* has no English equivalent.

viz., (*a*) medical (and apothecary) *feldshers ;* (*b*) regimental *feldshers.* Medical *feldshers* are not taken from the troops; they receive a medical training at special schools, which they enter at an early age. The course of training lasts four years; they then serve for a fixed term of years in the Army. The apothecary *feldshers* are taken from the medical *feldshers*. Both are classed in senior and junior grades and may, as *feldshers*, attain the lower official ranks.[1] Regimental *feldshers* are taken from the troops and trained for one or two years in regimental schools; in each regiment is maintained a school for the instruction of these men. Having been trained, they are appointed to regimental medical establishments and station hospitals.

In these notes the term "medical *personnel*" will be used as including surgeons and *feldshers*.

Attendants for duties directly or indirectly concerned with the care of sick and wounded are, ordinarily, trained soldiers taken from the troops (on mobilisation from the reserve). They are comparable to regimental orderlies, but actually form part of the *personnel* of the medical establishment or unit to which they belong. They wear the prescribed uniform of the same. Senior attendants are usually (*a*) ward superintendents, or (*b*) hospital superintendents. Ward superintendents (classed according to two rates of pay and corresponding to our orderlies in charge of wards and other orderlies of the Nursing Section) are selected on account of special suitability for the care of sick. Hospital superintendents are selected from the ward superintendents; they are practically non-commissioned officers, but the corresponding term in Russian is not applied to senior attendants holding this non-combatant grade. Non-commissioned officers appointed to medical establishments and units for special duties may hold this grade.

Transport *personnel* is provided in a similar way—on mobilisation from the cavalry reserve.

Other individuals found in the *personnel* of medical units are overseers and assistant overseers (special officials, unless an officer is appointed for the duties of overseer), accountants (officials), clerks (a special service), chaplains, sacristans and sisters of mercy (not under religious vows). The duties of overseers comprise those of a quartermaster in our own Corps, and supervision of attendants not directly employed in the care of sick and wounded.

[1] The value of this branch appears to be (as might be expected) much greater than that of the analagous service in India.

In peace time the ordinary medical establishments are regimental *lazarets* and station hospitals under the direction of officers. The word *lazaret* has no exact equivalent in English; an equipment (for the treatment of sick) inferior to that of a hospital is implied.

The word "cart" will be used below as a translation of the Russian word designating a two-wheeled vehicle.

Administration of the Medical Service in the Field.—The administration of the medical service of an army in the field is, by the regulations of 1890, conducted by a general officer who holds the appointment of *Dejourny-General* (the word *dejourny* may be translated as "orderly"). This officer is on the field staff (inspectorial branch) and subject to the Chief of the Staff. His duties are various and important; among them is, or was, included the administration of the medical service. In the Manchurian War this branch of administration was taken out of the hands of the *Dejourny-General* and given over to an officer appointed Chief of the Sanitarian Branch of the Army, directly subject to the Commander-in-Chief of the (Field) Army. This was a new post; it may be considered that the appointment will be made in future campaigns, as the innovation was of practical value. An officer holding such an appointment is of the rank of Lieutenant-General. His office comprises hospital, medical and evacuation sections. His duties are the administration of the sanitarian service (including the veterinary service) and supervision of voluntary aid.

The following are assistants to the Chief of the Sanitarian Branch: (1) The Field Inspector of Hospitals of the Army (an officer); (2) the Field Medical Inspector of the Army (a medical official); (3) the chief delegate of the Red Cross Society.

To the Field Inspector of Hospitals are subject: (*a*) Local chiefs of hospitals; (*b*) presidents of evacuation committees; (*c*) reserve of non-medical *personnel* (for medical units of the Army). He is the departmental chief of the non-medical *personnel* of medical units.

To the Field Medical Inspector are subject: (*a*) The Chief Surgeon[1] (*glavny chirurg*); (*b*) the Senior Surgeon at Headquarters (of Field Army); (*c*) reserve of medical *personnel*. He is the departmental chief of the medical *personnel* of the Army (for post-

[1] An expert in surgery. His duties are to generally superintend surgical work (performing difficult operations) and care of instruments, appliances and dressings, supervising in this respect the field depôts of medical stores. He keeps an account of the surgical work of the campaign.

ings, changes and administration). Field depôts of medical stores and temporary magazines of medical stores are under his control.

Other new appointments held by officers during the Manchurian War were—that of a Chief of the Sanitarian Branch in rear of the Field Army (he was stationed in Manchuria) and that of Chief of the Sanitarian Evacuation Branch (in Siberia).

Medical establishments and units are, naturally, under the control of the various commanders of the army corps, divisions, brigades, regiments, to which they are attached or belong.

Powers of medical administration are exercised by: (1) Army corps surgeons; (2) divisional and brigade surgeons; (3) senior or chief surgeons of regiments and medical units.

Regimental Medical Establishments.—Each regiment, or other unit mentioned below, has a *lazaret* for the immediate and temporary treatment of sick and wounded in numbers as follows :—

Infantry 4-battalion regiment	16 beds
Cavalry regiment	6 ,,
Independent battalion	4 ,,
Artillery brigade of 6 batteries or 4-battery regiment ..	6 ,,
Artillery brigade of from 7 to 9 batteries	8 ,,
Park artillery brigade or independent artillery division ..	4 ,,

These *lazarets* form advanced dressing stations during fighting. The senior surgeon of the unit is the immediate chief of such a *lazaret* (under conditions of active service officers are not appointed to command these). The table on the next page shows the provision made in various combatant units for medical aid.

A proportion of the *feldshers* are medical *feldsher* officials and apothecary *feldshers :* an infantry regiment, for instance, has one of each.

The number of superintendents and attendants, and the strength of the transport *personnel* (all supplied from the unit), is proportionate or according to requirements: 1 sergeant as superintendent and 3 *lazaret* attendants, is the usual complement for an infantry regiment in peace time.

Medical comforts of various kinds—tea, sugar, wine, spirits, cranberry extract, &c.—are carried.

Each surgeon has a surgeon's instrument case, each *feldsher* a *feldsher's* instrument case. *Feldshers* carry also special *feldsher's* bags for dressings, &c. A surgical bag for dressings, &c., is issued to the bearers of each stretcher. Besides the first field dressings issued (since 1904) to the troops individually and those in the *feldshers*' and bearers' surgical bags, a reserve of the same forms part of the equipment of each unit. Each *feldsher's* bag contains

10, and each bearer's bag 20; there are 440 in the *lazaret* of an infantry regiment, and 220 in the *lazaret* of an artillery brigade. In the *lazarets* of other units, and in the train of units not having *lazarets*, first field dressings are carried, 1 for each 10 men of the established strength, plus 10 per cent. The bedding and clothing equipment consists of bags for mattresses and pillows, bed linen, blankets, hospital gowns, vests, woollen stockings, &c.

—	4-battalion infantry regiment	Separate (or independent) battalion	Cavalry 6-squadron, or Cossack 6-*sotnia*, regiment	Foot artillery brigade	Horse batteries and light batteries (for rifle brigades)
Surgeons	5	2	2	2	1
Feldshers (not counting veterinary *feldshers*)	22	6	9	7	2
4-horse ambulance wagons (for 4 lying, 1 sitting, or 8 sitting)	4	1	—	3	—
2-horse ambulance wagons (for 2 lying or 4 sitting)	—	—	2	—	1
1-horse carts for medical and surgical *materiel*	4	1	1	2	1
2-horse wagon for *lazaret* baggage, including stretchers	1	1	—	—	—
1-horse medical cart	—	—	—	1	—
1-horse medical and veterinary cart ..	—	—	1	—	—
Stretchers and surgical bags for bearers, of each	32	8	6	12	2
Trained bearers (4 for each stretcher, except in artillery brigades)	128	32	24	36	6
Preserved rations (meat, vegetables and meal; reserve in *lazarets*)	160	40	60	60	—
Tent, officers' pattern, for advanced dressing station	1	1	—	—	—
Clothing, bedding, utensils, and furniture, for	16	4	6	6	2

The regimental bearers are trained by the senior surgeon of the unit, and by an officer appointed for the duty. Though shown in the foregoing table, they form part of their own companies, squadrons, *sotnias*, batteries or parks. There are 8 bearers in each infantry company, 4 in each squadron, *sotnia* or park, and 6 in each battery. These numbers correspond to the number of stretchers in the equipment of each unit, 4 men to each stretcher, except in the artillery brigades, where there are only 3 bearers for each stretcher, this deficiency being made good by *lazaret* attendants.

It may here be noted that the Russians seem fully aware that it is necessary that all bearers and attendants on sick should be of good physique.

The following examples show at a glance the capabilities of

the more important regimental establishments. By its own medical organisation a 4-battalion infantry regiment may (*a*) accommodate 16 patients; (*b*) transport, at the same time, in ambulance wagons, from 20 to 32 wounded; (*c*) transport, at the same time, on stretchers, 32 wounded; (*d*) provide food, at its own dressing station, for 160 men for one day. A 6-squadron cavalry regiment may (*a*) accommodate 6 patients; (*b*) transport, at the same time, in ambulance wagons, 4 wounded lying or 8 wounded sitting; (*c*) transport, at the same time, on stretchers, 6 wounded; (*d*) provide food for 60 patients, for one day.

Medical Units.—Under this heading may be classed the extra-regimental establishments, viz., divisional and brigade *lazarets* (alternative units, the function of which is practically the same as that of our late bearer companies), field hospitals (mobile and reserve), invalid detachments, fortress temporary hospitals, sanitarian convoys, hospital trains, hospital ships, any already established permanent hospitals which may be available, and the flying sanitarian detachments.

Divisional Lazarets.—One divisional *lazaret* is provided for each infantry division[1] (whether of the active army or of the first or second reserve). Its function is to form a main dressing station during fighting, and to co-operate with the combatant units of the division in moving back sick and wounded. The following table shows the *personnel* and equipment:—

Officer	1
Surgeons, including divisional surgeon and his assistant ..	5
Overseer official, assistant to officer (as overseer)	1
Feldshers, medical (of whom one is of senior grade or an official)	3
Feldsher, apothecary	1
,, veterinary	1
Clerks	2
Attendants, including two seniors	22
Company (*rota*) of bearers, 1 Sergt.-Major, 16 other N.C.O.'s and 200 men. Strength	217
Transport *personnel*, including 1 senior and 1 junior N.C.O.	39
4-horse ambulance waggons (each for 4 lying and 1 sitting, or 8 sitting)	8
2-horse baggage waggons	15
1-horse carts for medical and surgical *materiel*	3
4-horse waggon, of special type, for tents	1
Stretchers	50
Surgical bags for bearers	50
Marquees (each for 20 men)	4

[1] A cavalry division has no divisional *lazaret* or divisional field hospitals. A reserve of fifty-five field dressings is carried in its train.

In addition to number of horses (50) indicated, there are 4 riding horses, 1 each for the officer, the overseer official and the transport non-commissioned officers; also 3 spare horses.

Four hundred preserved rations are carried, and medical comforts of various kinds. There is a reserve of 550 first field dressings (besides those in the bags for *feldshers* and bearers). Bedding and clothing equipment (of much the same kind as for a regimental *lazaret*) for from 5 to 10 officers and from 50 to 100 of lower ranks is carried.

To summarise capabilities: (*a*) 50 wounded can be carried, at the same time, on stretchers; (*b*) 40 wounded (32 lying, 8 sitting) can be carried, at the same time, in ambulance waggons; (*c*) 80 wounded can be accommodated in tents; (*d*) 400 wounded can be fed for one day.

The chief of the divisional *lazaret* is the divisional surgeon, who controls also the divisional field hospitals. The officer commands the company of divisional bearers and the non-medical *personnel* generally. He is also an overseer.

Brigade Lazarets.—Brigade *lazarets* have no part in the ordinary infantry division, but are provided (1 for each independent brigade of 2 regiments) for 5 rifle brigades of European Russia and for the rifle brigades of Finland (I use, in this connection, the word "rifle" in deference to custom; "sharpshooter" would be a better rendering). The function of this unit is on the whole similar to that of a divisional *lazaret*. The *personnel* and equipment are as follows:—

Officer	1
Surgeons, including the brigade surgeon	4
Overseer official, assistant to officer (as overseer)	1
Feldshers, medical	3
Feldsher, apothecary	1
Feldsher,[1] veterinary	1
Clerks	2
Attendants	14
Detachment (*komanda*) of bearers, 11 N.C.O.'s and 130 men, strength	141
Transport *personnel*, including 2—N.C.O.'s	32
2-horse ambulance waggons	8
2-horse baggage waggons	15
1-horse carts for medical and surgical *materiel*	2
Stretchers (besides 16 in ambulance waggons)	40
Surgical bags for bearers	40
Small tents	5

[1] The detail here given of veterinary and clerical *personnel* has not been checked by official tables.

The unit is divisible into two sections. Preserved rations for 384 men and medical comforts of various kinds are carried.

The chief of a brigade *lazaret* is the brigade surgeon. The officer commands the detachment of bearers and the non-medical *personnel* generally, and is overseer.

It may here be noted that rifle brigades having no field hospitals carry in the train a reserve of 400 field dressings.

Field Hospitals.—For every infantry division, whether of the active army or of the first or second reserve, eight field hospitals (four mobile and four reserve) are provided; of this number two (mobile) are attached to each infantry division, and are termed Divisional Field Hospitals. The cavalry divisions and rifle brigades (with the exception of the rifle brigades of Finland, to each of which is attached one mobile field hospital) have no field hospitals. For the eastern Siberian rifle divisions, Nos. 1, 2, 3, 4, 5, 6 and 9, three mobile and three reserve field hospitals (for each division) are appointed.

The difference between a mobile and a reserve field hospital is that the latter has no transport, tents or store of food, and only two stretchers instead of forty. Either is intended to accommodate 10 officers and 200 of lower ranks.

The two divisional field hospitals form, with the divisional *lazaret*, the sanitarian section of the divisional train. These hospitals are opened to receive wounded from the dressing stations, also when the division remains halted and no other hospitals are near. Treatment in the divisional hospitals is, of course, intended to be merely temporary. When a division moves on and it has not been possible to completely empty the divisional hospitals, one may be left behind to join again at the earliest opportunity. It is intended that a mobile field hospital shall, when occasion requires, carry back wounded as far as one day's march (25 versts or 16·6 miles). The two-horse baggage waggons may, after unloading, be used for this purpose.

It is considered that buildings will usually be available for the reception of sick and wounded, though the mobile hospitals have accommodation for sixty men.

The mobile field hospitals not attached to divisions and the reserve field hospitals are distributed in the field of operations, moved, open and closed by order of the Field Inspector of Hospitals, under the general direction of the Chief of the Sanitarian Branch. Some of the reserve field hospitals are stationed at *etapes* to give temporary accommodation and rest, even for a night, to sick and

wounded passed back on lines of communication. Field hospitals attached to divisions are directly subject to the divisional surgeon, under the orders of the divisional commander. Mobile field hospitals not attached to divisions and reserve field hospitals are under the control of the Field Inspector of Hospitals as regards general administration and internal management as units, but in medical respects they are controlled by the Field Medical Inspector.[1]

	Mobile	Reserve	Massed		Grades of rank
			420 beds	630 beds	
Chief Surgeon	1	1	1	1	VIII.
Surgeons, senior..	1	1	2	3	VIII.
,, junior..	2	2	4	6	IX.
Apothecary, official, in charge of dispensary	1	1	1	1	VIII.
Feldshers, senior medical	3	3	4	6	
,, junior ,, ...	4	4	8	12	
,, senior apothecary	1	1	2	3	
,, junior ,, ...	1	1	2	3	
,, junior veterinary	1	—	2	3	
Overseer (officer, of not higher corresponding rank, or official)	1	1	1	1	VIII.
Overseer officials, assistants	1	1	2	2	IX.
Accountant official	1	1	1	1	IX.
Chaplain	1	1	1	1	
Sacristan	1	1	1	1	
Sisters of Mercy	4	4	8	12	
Clerks, higher pay	1	1	1	1	
,, lower pay	2	2	3	4	
Hospital Superintendents—Sergt.-Major ..	1	1	1	1	
,, ,, Qmr.-Sergeant..	1	1	1	1	
,, ,, Senior attendants	4	4	7	11	
Ward superintendents, higher pay	5	5	8	12	
,, ,, lower pay	20	20	40	60	
Ordinary attendants	34	34	70	100	
Transport N.C.O.'s, senior	1	—	—	—	
,, ,, junior	1	—	—	—	
,, privates	26	2	—	—	
4-horse ambulance waggon (ordinarily for Sisters or Mercy)	1	—	—	—	
2-horse baggage waggons	19	—	—	—	
1-horse carts for medical and surgical *materiel*	4	—	—	—	
4-horse waggon, of special type, for tents ..	1	—	—	—	
Stretchers, each with a surgical bag for bearers	40	2	—	—	
Marquees (each for 20 men)	3	—	—	—	

The chief surgeon is the immediate chief of the unit. To assist him an officer is usually appointed to control management and as chief of the non-medical *personnel*. If several field hospitals are

[1] These notes on administration are somewhat tautological, but I have endeavoured, by citing regulations for units, to exemplify the general system.

opened in one place an officer is appointed as Local Chief of Hospitals. Two or three field hospitals may be massed or joined together to form hospitals of 420 or 630 beds, termed massed hospitals.

The usefulness of the mobile field hospitals not attached to divisions is obvious, and it will be noted that the reserve and massed hospitals supply the place of our stationary and general hospitals. The preceding table shows the *personnel* and equipment of field hospitals.

A mobile hospital has fifty-three draught-horses (three spare) and four riding horses, one each for overseer, assistant and transport non-commissioned officers.

In each hospital one of the medical *feldshers* may be an official.

Divisional field hospitals have three junior surgeons.

A mobile hospital carries a reserve of 400 preserved rations, with medical comforts of various kinds.

The equipment of a field hospital includes bedding, clothing, ward furniture and utensils.

The following table gives the numbers of the principal articles in the bedding and clothing equipment of a mobile hospital:—

	For officers	For lower ranks
Pillow cases	60	600
Sheets	30	600
Bags for pillows	—	300
,, ,, mattresses	—	300
Shirts	30	600
Drawers	20	600
Blankets	12	250
Gowns	12	250

It will be noted that the *personnel* of massed hospitals does not altogether correspond to the full complement of two or three field hospitals. The strength of the transport *personnel* and number of vehicles for the massed units is determined, according to need, by the Field Inspector of Hospitals. It is worthy of observation that, for the purpose of transferring wounded from divisional hospitals to other medical units, the transport at the disposal of an infantry divisional commander consists, according to regulations, of eight ambulance waggons of the divisional *lazaret*, two ambulance waggons and thirty-eight baggage waggons of the two divisional field hospitals.

Invalid Detachments.—These detachments are formed as required (with the sanction of the Chief of the Sanitarian Branch), and stationed in the vicinity of field hospitals not attached to

divisions. Each consists of from 50 to 200 men not actually requiring treatment in hospital, who may be enfeebled by marching and hardships, slightly wounded, injured, or ill. These detachments are controlled in medical matters by the chief surgeon of the field hospital, but an officer, appointed by the Chief of the Sanitarian Branch, is in command. The detachments are administered as companies, and the posts of sergeant-major, section non-commissioned officers, accountant, baker and cook are filled by convalescents.

Fortress Temporary Hospitals.—These are units, of definite constitution, opened in fortified (permanently or semi-permanently) places in time of war if the accommodation in the medical establishments maintained in peace time should prove inadequate. Each is intended to accommodate twenty officers and 400 of the lower ranks. The following table shows the *personnel* :—

Chief surgeon	1
Surgeons, senior	2
,, junior	4
Apothecary official in charge of dispensary	1
Feldshers, medical, senior	4
,, ,, junior	8
,, apothecary, senior	2
,, ,, junior	2
Overseer (officer or official)	1
Overseer officials, assistants	2
Accountant official	1
Sisters of Mercy	8
Clerks, higher pay	1
,, lower pay	3
Hospital superintendents, Sergeant-Major	1
,, ,, Quartermaster-Sergeant	1
,, ,, Senior attendants	7
Ward superintendents, higher pay	8
,, ,, lower pay	40
Ordinary attendants	70
Transport privates	4

One of the medical *feldshers* may be an official.

Four hundred preserved rations and medical comforts of various kinds are in the store.

Sanitarian Convoys (*transporti*).—These are provided in numbers not exceeding one for each army corps mobilised.

Each convoy can transport 200 wounded (60 lying, 140 sitting); it can, therefore, take over at once nearly the whole number of patients in a field hospital, or possibly more, as in place of every two lying cases may be put four sitting.

Clothing and bedding is carried in quantity sufficient for sixty men (the number of lying-down cases). Preserved rations (384) and medical comforts are carried.

The units are subject to the Field Inspector; a field officer is appointed to command each. Their function is to assist everywhere (in the sphere of military operations) in moving back sick and wounded: (*a*) from bodies of troops actively engaged to the nearest hospitals; (*b*) from the dressing stations and field hospitals in the area of active operations to other medical units; (*c*) from one unattached field hospital to another, or to railway stations or steamboat harbours, according to plan of evacuation. They also aid in returning to their units men who have recovered.

Besides these regulation units (the stores and train of which are maintained in peace time), it is intended that improvised *transporti* shall be formed, when necessary, in time of war from the army train and local transport. In the Manchurian war were formed half convoys for the transport of 100 men (thirty lying); the whole train was two-wheeled, and consisted of fifty carts for wounded, one for sisters of mercy, and one kitchen cart (cavalry pattern).

Regulated Establishment of Sanitarian Convoy.

Field officer in command	1
Surgeons (one senior)	2
Overseer official	1
Feldshers, medical (one senior)	3
Feldsher, apothecary (senior)	1
Feldsher, veterinary	1
Sisters of Mercy	2
Clerks (one on higher pay)	2
Attendants (two senior)	19
Transport N.C.O.'s (one senior)	3
,, privates	68
4-horse ambulance waggons	27
4-horse kitchen waggon	1
2-horse baggage waggons	7
1-horse cart for medical and surgical *materiel*	1

In addition to the 127 horses indicated, there are six spare horses and four riding horses, one each for the commanding officer and the transport non-commissioned officers.

Hospital Trains.—For the transport of sick and wounded, arrangements are made with the Minister for Railways that the railway companies shall in peace time keep up a certain number (according to mobilisation tables) of carriages suitable for hospital trains. These are third-class passenger carriages, constructed on

the Pullman system, having entrances such that a man may be carried in on a stretcher. When a carriage is prepared for the reception of severely wounded men (or serious cases generally) the upper and lower berths are removed, and special stands (with springs) are fitted, on Kruger's system. In carriages for slightly wounded, the men lie on ordinary seats or berths. In a hospital train there are, for the accommodation of sick and wounded, ten carriages. Of these, one carriage is for officers, and is prepared for eight severely and twelve slightly wounded. For lower ranks there are four carriages, taking eighteen cases each; for severely wounded and for slightly wounded five carriages, taking at least thirty-two cases each. The total number of wounded carried is therefore 252 (including twenty officers). Each train is fully equipped for this number; two changes of bedding and clothing are carried, with a reserve of 40 per cent. of one change.

The following table shows the composition of a train:—

	Carriages.
For wounded officers	1
For severely wounded of lower ranks	4
For slightly wounded of lower ranks..	5
For clothing and bedding, &c. (store waggons)	2
For kitchen and provisions	1
For dispensary, bath, surgery, and accommodation of Sisters of Mercy	1
For commander, surgeons and overseer official	1
For lower *personnel*	1
Total.. ..	16

All carriages are four-axle third-class passenger carriages, except the store waggons, which are three-axle goods waggons.

The *personnel* is as follows:—

Officer, commanding	1
Surgeons	3
Overseer official	1
Feldshers	4
Sisters of Mercy	5
Attendants employed in care of patients	25
Attendants employed in details of management	20

The commander has the full powers of an officer commanding a combatant unit. He receives, one month in advance, cash for maintenance of train.

The service of hospital trains within the area controlled by the staff of the field army is subject to the Chief of the Sanitarian Branch; otherwise, hospital trains are under the direct control of the General Staff (at St. Petersburg).

In addition to the military hospital trains, other hospital trains

are provided in time of war by the Red Cross Society and other public bodies, and also by private munificence; all are subject to conditions laid down by military authority. Each of these trains must have a combatant officer as commander, and must conform to the regulations for military hospital trains. A delegate for supervision may be appointed by the persons who provide the train.

Provisional military hospital trains may be formed according to need in the event of an evacuation, *en masse*, of the advance medical units. These trains are organised and managed, as far as possible, in the same manner as are those regularly constituted. If passenger carriages be not available, goods waggons may be used. Bath and surgery (for operating and dressing) compartments may be dispensed with, and improvised kitchen carriages may be used instead of those of special type.

In the Manchurian campaign, after great actions, wounded were placed on straw on the floors of goods waggons; in cold weather waggons having double walls and other protection, and containing warming apparatus, were used.

Hospital Ships.—For the purpose of assisting in moving back the sick and wounded of an army; such ships work chiefly (as far as Russia is concerned) on inland seas, lakes and rivers. Regulations are in force for the equipment and management of available steamers, but, owing to diversity in type of steamers employed, or intended for employment, information regarding them cannot be advantageously condensed.

Field Depôts of Medical Stores and Temporary Magazines of Medical Stores.—The field depôts are established at points conveniently situated for the object for which these units are intended, viz., for supplying regimental medical establishments and medical units. They contain stores of dressings, medicaments, surgical instruments and appliances and dispensary apparatus. Of surgical instruments and appliances they maintain a reserve supply equal to one-fifth of the whole quantity distributed in the field hospitals and divisional *lazarets*.

In each depôt is a special establishment for the repair of instruments, appliances and apparatus.

If the distance from the field depôts to the permanent magazines (from which the depôts are supplied) is inconveniently great, temporary magazines of medical stores may be established, by agreement between the Commander-in-Chief of the Field Army and the Minister for War.

A field depôt has the following *personnel* :—

Officer, commanding	1
Apothecary officials	2
Feldshers, apothecary (one senior)	3
Clerk (higher pay)	1
Senior attendants, higher pay	1
,, ,, lower pay	1
Attendants (ordinary)	15

Permanent Hospitals.—Such of the military station hospitals, and hospitals generally, civil or military, maintained by the State, which may be within the sphere of operations, are made use of for the disposal of sick and wounded, under the orders of the Commander-in-Chief of the Field Army.

Reserve of Sanitarian Personnel.—For the field army, in addition to the *personnel* for medical establishments and units, the following reserve is provided :—

Surgeons, 10 per cent. of total.
Feldshers, 5 per cent. of total.

This reserve is at the disposal of the Field Medical Inspector.

There is also a reserve of other *personnel*, for hospital management generally, of 5 per cent. of the total. This is at the disposal of the Field Inspector of Hospitals.

Flying Sanitarian Detachments.—Flying sanitarian or disinfection detachments are formed, when required, in peace time or during war, under the direction of the chief medical authority, to give help in dealing with, and to aid in preventing, outbreaks of epidemic disease. They afford skilled direction and prompt help in emergency, and have all necessary means for disinfection and for bacteriological investigation.

The chief of such a detachment is a surgeon. The remaining *personnel* includes one or two other surgeons, with the requisite number of *feldshers*, attendants, &c. The actual number of these, and the nature and amount of transport and equipment, is determined by circumstances.

Evacuation of Medical Units.—Special arrangements are made for the methodical and organised emptying of the field hospitals. To estimate the necessity for such arrangements the available accommodation in medical establishments and units should be compared with the number of men which may be expected to pass through these.

It is found that the average percentage constantly sick in peace is from 2 to 2½ per cent. To meet peace requirements there is accommodation in the regimental *lazarets* and other medical establishments for 3 per cent. But in war it is found that the per-

centage of sick and wounded may be expected, during some periods, to reach 28 per cent. The accommodation in the field hospitals (mobile and reserve) is sufficient for 7·4 per cent. of established strength of combatant units composing the field army. Adding the available accommodation in regimental *lazarets*, it is found that the total amount of accommodation is sufficient for 7·8 per cent. of the total strength. The amount of accommodation in individual and brigade *lazarets* cannot be taken into consideration, as these units are not intended for the treatment of sick.

The above considerations render obvious the necessity for organised evacuation.

In the general scheme for evacuation areas are allotted in which, according to their geographical position, the work of evacuation is either under the control of the Chief of the Sanitarian Branch or of the General Staff (in St. Petersburg). Those under the control of the Chief of the Sanitarian Branch are termed Field Sections; or, if the exigencies of administration demand, they are sub-divided into Field and Rear Sections. Areas under the control of the General Staff are termed Inner Sections.

In each section is established an (executive) Evacuation Committee, termed a Field, Rear or Inner Evacuation Committee.

Field and Rear Evacuation Committees establish (at the places where they are posted) collecting stations for receiving sick and wounded and for sorting them, with a view to further disposal, according to the nature of the various disabilities. Inner Evacuation Committees deal with the further removal or disposal of sick and wounded as they recieve them. Field and Rear Evacuation Committees consist of a general officer or colonel, as president, a field officer as assistant to the president, a chief surgeon of the committee, a member detailed by the Chief of the Field Department of Roads and (if the committee be established near an *etape*), by the commander of the *etape*. A member is also, generally, appointed by the President of the Red Cross Society.

The presidents of these committees are subject to the orders of the Field Inspector of Hospitals. Inner Evacuation Committees have a similar constitution and are established by orders of commanders of military districts.

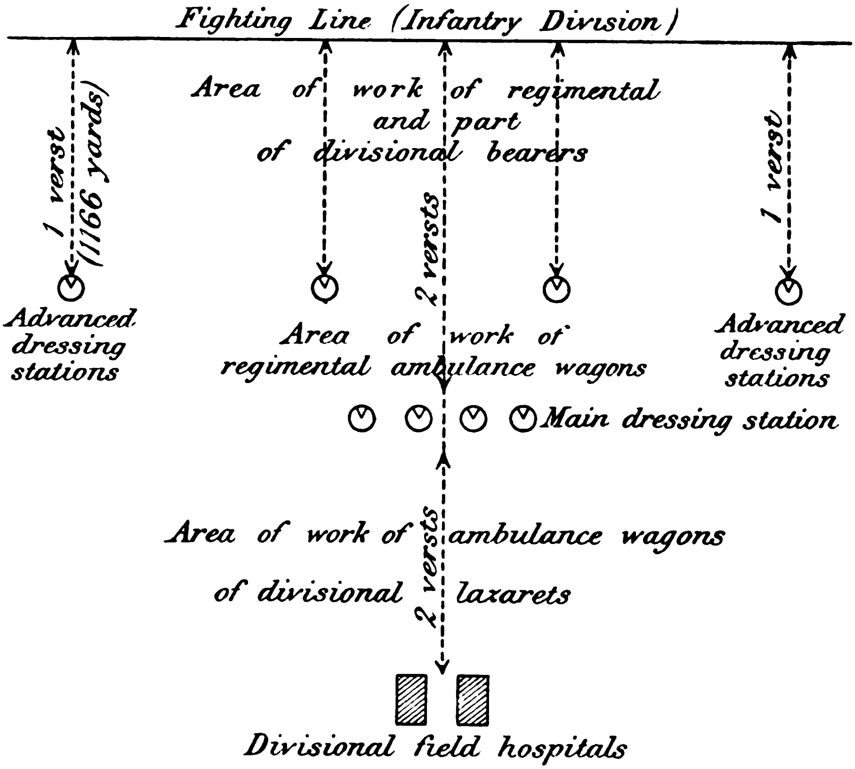
The *personnel* of a collecting station consists of the chief surgeon of the committee, several other surgeons, seven *feldshers*, a number of attendants, of whom forty-five are employed directly in the care of sick and wounded, and six sisters of mercy.

In the department of military communications of the General Staff is established the Chief Evacuation Committee, the members

of which are taken from the General Staff, Chief Military Sanitarian Committee, Chief (or Headquarters) Office of the Military Medical Service and Chief Office of the Red Cross Society. This body issues recommendations, but is not executive.

To aid and to complete the work of the military organisation, Government or district executive committees are established in governments or districts by order of governors, under whose supervision they work. They deal with the maintenance, lodging and transport of sick and wounded sent back from the seat of war.

Method of work, during action, of Regimental Medical Establishment and Medical Units.—The following diagram is intended to show the plan on which work in action is done :—



As mentioned above, the advanced dressing stations are formed by the regimental *lazarets*, and the main dressing station by the divisional *lazaret*.

If necessary a part, at least, of the divisional bearers go forward

to assist the regimental bearers. When an action is expected, the regimental bearers are asked for by the senior surgeons of regiments, or sent to them directly by the officer commanding regiments. Leaving their companies, the bearers march in front of the regimental waggons till they reach the place chosen for the advanced dressing station. Here arms and ammunition are laid down, stretchers and surgical bags are received, and special duties commence. If the work of removal of wounded is carried out by the regimental bearers only, an officer is posted at each advanced dressing station. His duties are to supervise the work of the regimental bearers generally, but especially to see that the stretcher squads do not pass further back than the dressing station (advanced), and to give orders for the further sending back of wounded who have been inspected by the surgeons (who remain at the advanced dressing stations). Each battalion furnishes this officer with a non-commissioned officer. The non-commissioned officers supervise the removal of the wounded from the fighting line to the advanced dressing station.

Commanders and non-commissioned officers of bearers are provided with whistles; these are only to be used after an action (a practical point).

Ambulance waggons are to be placed, if possible, under cover, the regimental near the advanced, and the divisional near the main, station; horses' heads to the rear. The regimental waggons work only from the advanced to the main station, and are not on any account to move further to the rear. The divisional waggons move no further back than the divisional field hospitals. In emergency some of these waggons may be sent forward (with bearers) to the advanced stations. Waggons returning empty after unloading move at speed, taking vacated stretchers; if bearers carrying wounded are met, the waggons must not be halted to take the wounded.

Bearers take back, with the wounded, arms and ammunition, first unloading and uncharging the rifles. At the dressing stations soldiers, specially told off, collect arms and ammunition, which are sent on to the field hospitals, and from these units at the earliest opportunity to the commander of the nearest *etape*.

Operations are done at advanced dressing stations only in case of great urgency; cases requiring later operation are separated from others (as the former should be sent back without delay); hopeless cases are placed apart, to receive the ministrations of chaplains.

Calculations showing Time Required for Clearing Field of Action, &c.—The following calculations, taken from M. Maksheef's published lectures, are of interest. They are applied to an infantry division (without artillery). Supposing the total loss to be 25 per cent., the proportionate numbers of killed, slightly wounded and severely wounded may in the light of experience be taken as:—

	Each Regiment.	Whole Division (4 Regiments).
Killed, 5 per cent.	200 ..	800
Slightly wounded, 13 per cent.	520 ..	2,080
Severely wounded, 7 per cent.	280 ..	1,120

Removal from Fighting Line to Advanced Dressing Stations.—There are with each regiment thirty-two stretchers. The time required for each removal and return is about one hour. Dividing the number of severely wounded by the number of regimental stretchers, we find that this stage of the removal occupies nearly nine hours time, if regimental means alone are used.

Removal from Advanced to Main Dressing Stations.—The ambulance waggons of each regiment carry sixteen wounded, lying. The time required for each removal and return is about half an hour. Dividing the number of severely wounded in each regiment by sixteen and halving the result, we find this stage also occupies nearly nine hours time.

Removal from Main Dressing Stations to Divisional Field Hospitals.—The ambulance waggons of the divisional *lazaret* carry thirty-two wounded, lying. The time required for each removal and return is about one hour. Dividing the number of severely wounded of the division by thirty-two, we find that this stage of removal occupies about thirty-five hours. Further, we note that 1,120 beds are required, or more than the accommodation of five field hospitals. If so many be not available, arrangements must be at once made for further removal.

If it should be thought that to base calculations on a supposed loss so great as 25 per cent. is unpractical, many historical instances of heavier loss may be adduced. For example, at the battle of Shipka (August 26th, 1877) one mobile *lazaret* alone, of the 14th Infantry Division, received 1,243 wounded.

Taking the loss to be only 12½ per cent. we obtain the following time-rate for removal of severely wounded:—

To the advanced dressing stations..	4½ hours.
From advanced to main dressing station ..	4½ ,,
From main dressing station to hospitals.. ..	17½ ,,

To shorten the last period, other means besides the ambulance waggons of the divisional *lazaret* must be used.

THE DIFFICULTIES OF INDIAN SANITATION.

By Colonel R. H. FORMAN.
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A few months ago, by courtesy of the Editor of this Journal, and perhaps somewhat at the expense of his reputation for perspicuity and tactful policy, I contributed an article entitled, "The Humour of Indian Sanitation." I hasten to add that I accept all responsibility for that article, and that his share therein was entirely passive, perchance even obstructive or actively hostile. I do not know. But if I then approached the subject from the humourous standpoint, and laughed at many of the vagaries that distinguish our sanitary methods, there was a very serious purpose underlying my pleasantries; for I fully recognise that preventive medicine spells the alleviation of suffering and misery, and the preservation of human life—subjects whose humorous aspect is somewhat strained, and in which the ironical laugh may well degenerate into the sob of pity and commiseration. There are but few of us with any experience and length of service who do not know and fully appreciate what I might term "the grey grim tragedy of the East." We see it daily in our hospitals, and the echoes reach us, in dumb appeal, from the English village, the Scottish clachan and the Irish cottage; nor would such appeal be made in vain if in us lay the power to answer it in the way it *should*—in the way it *must*—be answered; for of a surety there is no reason whatever, in these days of scientific insight into the causation and therapeutics of disease, why enteric fever, malaria, and the whole gamut of tropical ailments should not be scotched, or even permanently eliminated. Is this assertion true? I say, Yes, and I say it emphatically. Therefore, wherever the blame may lie—in active opposition or in passive indifference—we are guilty of a national crime, which should compel us to hide our heads for very shame, and force us to acknowledge that our boasted humanitarianism is but the vain-glorious vapourings of blatant self-advertisement and pharisaical sham. Verily a crushing indictment, but none the less deserved.

It goes without saying, that the first difficulty which confronts us in Indian sanitation is the apathy and crass ignorance of the native population—their prejudices, their superstitions, their innate conservatism and the passive resistance which is so hard to over-

come, and which almost seems to compel them to oppose. It must be admitted that we are met here, at the very outset, by an insuperable obstacle, or at any rate one that will take generations of education to eradicate; and at first sight it would almost appear that the existence of the bazaars in close proximity to the troop lines, wallowing in the filth and squalor of an immemorial custom, and disseminating disease broadcast, as they do, would make us acknowledge defeat, and force us to shrink from the herculean task discouraged and dismayed. Mayhap! Yet, if tradition is to be relied upon, it has never been a national characteristic to shirk a problem, be it ever so difficult, and we may well hope that sufficient racial virility remains to make us scorn so obvious and so pusillanimous a neglect of duty. Let us remember that almost within the memory of living man England herself was just as deeply sunk in the slough of hygienic ignorance; and that whilst we had to work our way slowly upward towards the light, India has the inestimable advantages of our knowledge and our experience to fall back upon, and lead her by a far shorter and less rugged path to the goal. Let us remember, also, that but a few decades ago the death-rate of British soldiers in India was, approximately, sixty per thousand per annum, as against about sixteen now; and then say, if we dare, that our work is done and our object attained. There is still an enormous amount of preventable disease in our midst, and, if preventable, it is a cowardly mental attitude to assert, or even imagine, that we cannot prevent it. We can, and the progress of the past proves that we can. Now, it is certain that in bygone days the condition of the bazaars was very much the same as it is now; the people have not changed their mode of living, nor are they better housed, nor better fed; yet, as already stated, the death-rate of the British troops during the last century has shown a steady and progressive fall, and this in spite of their native environment. Clearly, then, such improvement is for the most part internal, and not due to the betterment of extraneous conditions, albeit closer inspection of "followers," the provision of modern civil hospitals, and the slow awakening from ages of oriental apathetic fatalism, has exercised a concomitant influence. Still, if we study the vital statistics of the last thirty years, we shall, I think, arrive at the conclusion that there is an eddy in the onward sweep of the current; and it may fairly be assumed that one factor, *inter alia*, in this check, is our sanitary neglect of the "followers" and their bazaars. A wide subject—too much so for the limits of an article such as this—but there

is one thing about it which calls for special condemnation and presses for reform. It has always been the custom for mounted corps to own their "followers'" lines; buying them from their predecessors, selling them to their successors. Such a custom is indefensible from every point of view, and leads to multitudinous abuses. Naturally the commanding officer of, say, a field battery, cannot afford to spend much on such lines; for he cannot count upon his successor compensating him for improvements, nor can he squander his capital in view of future contingencies. Moreover, in crowded cantonments house property, no matter what its quality, means rent; and there is a natural tendency to admit all and sundry into the lines. Who shall blame the commanding officer? He is starved by Government, and he must make both ends meet somehow. Of course, the sequel is what one would expect from overcrowding and absolute neglect of even the rudiments of sanitation. Possibly, also, this in great measure accounts for the fact that the incidence of enteric fever in mounted corps is about double that of the infantry. I presume that it is scarcely necessary to indicate the remedy? it is patent to all. Let Government build and maintain proper lines for such "followers"; rigidly exclude all hangers-on therefrom, and incidentally limit the number of authorised "followers." Herein, then, lies one of the difficulties of Indian sanitation—the parasitism of the native submerged tenth. No one, other than the sanitarian, is really whole-hearted in his desire to eliminate him; he himself clings limpet-like to the source of his sustenance, exercising all his oriental cunning and *finesse* to maintain his position; Tommy Atkins likes him because he can loll in luxurious ease and smoke his pipe the whilst the helot cleans his boots and his accoutrements; the Commanding Officer suffers him because it prevents his men grumbling; and finally, Government winks at him because it staves off, for a time, the haunting spectre of capital expenditure. Oh, fools and blind! Will no one ever recognise in this benighted land that money well spent is money saved? Will no one see that a heavy death-roll and a swollen invaliding-rate is the extravagance of the spendthrift, the economy of delirium, and the crime of a nation? Must the selfish cry, "Am I my brother's keeper?"—useless and discredited of yore, even as it is now—be for ever dinned into our ears? I hope not, nor do I believe it.

And now, let me turn to another aspect of these sanitary difficulties which confront us—an aspect which may be summed up in a single sentence, viz., The absence of executive authority vested

in Administrative Medical Officers. When all is said and done, a Principal Medical Officer, under existing conditions, is a very helpless individual. He may know what to do, he may have all the will in the world to do it, but he cannot, for he is powerless. He is placed, nominally, on the staff of a General Officer—he is not so in reality—and his function is to *advise* the General on all matters bearing upon the health of the troops. Surely this is tantamount to saying that he is required to sink his individuality in another, and that other a layman. Parenthetically, I may here say that, with very rare exceptions, I have found such officers only too anxious to act on the advice tendered; but it needs no demonstration on my part to prove to anyone of ordinary intelligence that such advice, coming from an expert, cannot, in the nature of things, impress a layman with the same force or conviction which it would do if his mind also had been educated to grasp the vital significance of the facts under discussion. After all, the capacity of the human mind is very limited, and no man is capable of becoming an authority, in the full acceptation of that term, on more than one subject, in the span of a lifetime. Advice is one thing, power to act is another—and a very different thing—and when it comes to a matter of special knowledge, there can be no doubt as to which of these two is practical, and in accordance with common sense. As illustrative of my meaning, I may quote a sentence in an introductory address, given to a committee, of which I am a member, by one of the greatest soldiers and clearest-headed men that England, or any other country, has ever produced. Referring to the subject before the committee, he said: "We know that the expense will be great, and we are prepared to meet that expense, *provided* you can prove to us that we are on the right lines." Now there can be no question about the *bonâ fides* of the speaker, and of his earnest desire to do all within his power to further the object in view, but no more apt example of the difficulty I am labouring to illustrate could be deduced. His mind, like every other man's mind, has been trained in a groove which is certainly not the scientific groove; he does not see (why should he?) that his proviso produces an *impasse*, and that if Government waits for antecedent proof of rectitude before taking action, it may well wait until the advent of the day of judgment. Science is knowledge, and is based upon experiment capable of reproductions when conditions are identical; and experiment postulates many failures and many errors, both of judgment and technique, before the necessary conditions are arrived at with exactitude; and, there-

fore, to demand proof for monetary reasons without experiment, involves a *ὑστέρον προτέρον*—a placing of the cart before the horse—and lands us in a dilemma which is logically absurd. No man trained in scientific methods could fall into an error such as this, for it brings us face to face with a *non possumus*; it ignores the fundamental canons of experimental science; it fails to recognise that human success is inevitably the fruition of human failure, and it perpetuates the prevalence of those twin antagonists to the onward march of sanitation—inaptitude and procrastination—which aforetime have been, as they still are, the active enemies of human progress, and nowhere more so than in the East. I confess it is a somewhat difficult matter to suggest a remedy for this state of things, but one thing is certain, that until that remedy is found, advance will continue tortoise-like, and the sickle of "the reaper" will gather in an ever-abundant harvest. Clearly there must be one head, one central authority, one moving spirit, and equally clearly that centre must be the General Officer Commanding; for, although he may know nothing about sanitation, there is so much overlapping with matters in which he *is* an expert, that he becomes, so to speak, the point of least resistance. From a purely abstract point of view, a completely autonomous medical organisation would be the perfect ideal; but plainly that is impossible, and we must beware lest we—the doctors—fall into the very error I am animadverting against, by allowing our speciality to loom so large that it obscures, or blots out, the rest of the landscape. The Army was not made for the doctor: it is primarily an offensive fighting machine, and his part in the mechanism, albeit essential, is necessarily subsidiary. We pride ourselves on the fact that our mission is to save life and mitigate suffering, but we are apt to forget that the *raison d'être* of an army is oftentimes, unfortunately, the very antithesis of this, and that at times it must fulfil its destiny and do its duty, no matter what the tale of death and suffering may be. I need not labour the point, it is plain enough, but I draw attention to it because it is inherent in humanity to look at but one side of the shield, and if there is danger of our doing so, there is even greater danger of others doing so, particularly if their mental horizon is obscured by ignorance. Ignorance is the parent of obstinacy, even as "those damned doctors" is the countersign of the bigot, who, glorying in his own benighted blindness, scorns to be wise.

And this naturally brings one to another sanitary difficulty, which, though it is not peculiar to India, is certainly much in

evidence here. I mean the lack of interest in matters hygienic, displayed by the average regimental officer and the rank and file themselves. One is almost tempted to think, on occasions, that the whole aim and object in life of that egregious ass, Tommy Atkins, is to see how many pathogenic germs he can absorb into his ill-used body in the shortest possible space of time, and his officer appears, ofttimes, his willing and sympathetic coadjutor, not to say his imitator. It is of happy augury that of late there are some signs of an awakening, and that an effort is being made to drive home the lesson that a living mouse is of more value than a dead lion; still, there is a deplorable amount of ignorance extant, and the task of removing it, or even illuminating it ever so feebly, is as the labour of Sisyphus. *Exegi monumentum aere perennius* is seemingly the motto of the soldier, officer and man—aye! and of many a soldier-doctor too—and what with the universal belief in such awesome ailments as "chills on the liver," and the happy-go-lucky conviction that the stomach is specially designed by Nature to fulfil the function of a garbage receptacle, there is danger that those of us who have found the light may throw up our hands in despair and retire from the unequal conquest, dejected and dismayed. Tommy Atkins has an unlimited confidence in his own powers and in his capacity to "knock spots out of" any number of enemies—I am not going to gainsay him his harmless, if somewhat boastful, self-assurance—and I do not doubt that if he knew anything about it, he would be equally sure that he was capable of producing a peculiar breed of phagocytes, imbued with the same reckless courage as their progenitor, and thirsting to battle with any number of pathogenic germs. "Let 'em all come," is Tommy's war-cry, and he certainly acts up to it, physically and hygienically. Confidence, no doubt, is a priceless gift in the soldier, but there is such a thing as its being misplaced, and we see that but too frequently in the pathetic line of sheeted figures, corpse-like in their suggestiveness, battling hard for dear life, in the sombre gloom of the enteric wards of our station hospitals. Alas, poor Tommy! Where is his confidence and boastfulness then? Gone, as though they had never been, and in their place the wan wasted face gazing up at us in dumb appeal, as if he would say, did his soldier pride not forbid it, "save me from the result of my own blind folly." It is no fanciful picture this—it is grim, solid fact—and I remember well, some few years ago, taking two captains of a certain regiment, which was suffering severely from enteric at the time, and showing them its literal reproduction. Nor did I fail to point the moral, by

emphasising the fact that it was all preventable, and that upon them rested the onus of that prevention. After all, what is sanitation but a minute attention to detail? "Be clean," sums up the whole problem in two words, and if individuals and communities cannot, or will not, obey, then Nature exacts the penalty. They, and they only, must work out their own salvation; for it is no mere evanescent figure-of-speech, but the stern undiluted truth, which is conveyed in the well worn aphorism, "God helps those who help themselves." It is this very question of detail that constitutes the chiefest of our difficulties. Do we not all know how heart-breaking it is to see, day in and day out, the perpetuation of some flagrant sanitary defect which is easily rectifiable, but which defeats us, simply because the "circumlocution office" intervenes? I need not occupy space with illustrations—those with any experience can supply them easily enough, but it saps the energy of any man to feel that he is always battering against an apathetic and somnolent conservatism, whose hoary heresy is "leave well alone," and whose national anthem is "The song of the sluggard." Bricks without straw, forsooth! Apparently *we* are expected to erect cathedrals from road-sweepings. Why should it always be so? Why should we, a body of experts, who only crave opportunity to effect revolutionary reformation, be habitually smothered under an incubus of officialism? I do not know; unless I attribute it to that passion which, next to the sexual, is the ruling force of human action, the love of power. Legitimate enough and natural enough, in its way; but hardly commendable, or provocative of adulation, when its outcome is juggling with the lives of men. It is the dread, implied or acknowledged, that the sanitarian will be invested with authority at the expense of the holders thereof which is, I believe, at the root of the opposition. I do not mean to insinuate that there is any unworthy motive attached to such opposition—far from it—because, in my humble opinion, I believe it to be but the following of natural instincts, albeit those instincts, whether we admit it or no, but too frequently allure us into the bye-paths of egotism and self-conceit. We all think we can do things just a little better than our fellows; nor does the fact that we know little about the point at issue lessen our self-assurance, or lead us to hesitate in the expression of our views with a dogmatic force which is inversely proportional to the extent of our knowledge on the one hand, and the depths of our ignorance on the other. There is a good deal more of sincerity in the prayer of the Scottish poet, "gie us a guid conceit of oorselves," than is usually conceded, although perhaps,

with most of us, the supplication is somewhat superfluous, seeing that we are already so amply endowed. But I am digressing, and however interesting it may be to study human motives and speculate about the hidden springs of human action, their bearing upon the difficulties of Indian sanitation is not very apparent.

I have purposely refrained in the foregoing from formulating any set scheme as a corrective to the difficulties I have so briefly sketched; nor do I propose to do so now. Perhaps at some future time, should the spirit move me, and the Editor continue in his present complacent mood, I may air my views on this aspect of the subject also. The whole crux of the matter lies in this, that whereas the doctor's function is fully recognised in the treatment and cure of disease, and no one dreams of interfering with him, it is far otherwise with the much more important and intricate problems of preventive medicine. In the solution and practical application of these he is hampered on all sides, and the bitterness of wasted effort saps his energy, dulls his initiative and hurls him back, bruised and beaten, from what would almost seem to be the impassable and impermeable barrier of an iron destiny. *Si monumentum quæris, circumspice,* might well be our national epitaph, as, standing in the cemetery of many an Indian cantonment, we view the long rows of pathetic mounds—silent evidences of our failures—and reflect that had we not been wilfully blind and criminally obstinate, a very large number of them need never have been there. "So careless of the single life!" Aye! But do not let us whiningly lay the onus of blame on the shoulders of Mother Nature. We, and we alone, are the culprits, and verily upon us the vials of wrath should be poured.

AN OUTBREAK OF SOUTH AFRICAN HORSE-SICKNESS IN SOUTHERN ARABIA.

By Captain A. C. INGRAM.
Indian Medical Service.

In the autumn of 1906 an epidemic disease of equines appeared suddenly in the Aden Hinterland and gradually spread down to Aden. This disease proved to be South African horse-sickness.

The outbreak was first observed among some transport mules at D'thala, which is situated about 70 miles due north of Aden. On September 10th a mule, while at work, suddenly fell ill and died within a few hours, "frothing" at the nostrils after death. A second mule died on September 14th in an exactly similar manner. Between September 10th and November 7th, 16 mules died, or were shot when their condition appeared to be absolutely hopeless; 19 mules were sick of the disease, of which 8 appeared to be recovered. On September 28th the ponies of the Aden Troop in D'thala were attacked, and up to November 7th, 10 died, or were shot *in extremis;* 6 appeared to be recovered and 5 were sick. In addition, 3 officers' ponies were shot *in extremis* and 1 was sick on November 7th. One Conductor's pony appeared to be recovering. A pony belonging to the food contractor had died, and 2 out of 4 ponies belonging to the Amir of D'thala had died. I saw almost all these animals myself, and performed, or was present at, 9 *post-mortem* examinations. All presented the lesions of South African horse-sickness.

The Arabs in the vicinity of D'thala gave very conflicting accounts; but it appears to be fairly certain that about seven to ten days before the outbreak of the disease at D'thala, 2 horses and 1 mule died suddenly of a very similar disease at a place on the Turkish border about 10 miles from D'thala. It seems probable, therefore, that the infection came to D'thala from the north, by way of Turkish Arabia.

At about the end of October this disease appeared at Lakej, which is situated about half-way between D'thala and Aden. It is impossible to state the exact date of the outbreak at Lakej. On October 20th Major Smith, D.S.O., A.V.C., passed through Lakej and reported that no horses were sick in that place. On November 9th the Sultan of Lakej wrote that "38 horses had died within the last few days." On November 29th an Indian *salutry*

visited Lakej and reported that 10 horses in the Sultan's stables were sick, and that about 50 horses had died in the Lakej district.

Somewhere about the end of October the disease appeared in Shaikh Othman, 9 miles from Aden. In October 3 horses died in this place, but the cause of their death was not accurately ascertained. From November 1st to December 7th, 19 horses died in Shaikh Othman, and 1 horse was then sick.

In Khormaksar, about 3 miles from Shaikh Othman, 1 horse died in October and 4 in November.

In the Crater Aden 5 horses died in October; from November 1st to December 7th, 10 horses died, 2 were shot *in extremis*, and 2 remained sick. I saw several of the sick animals in the Crater and 1 *post-mortem* examination; they presented exactly the same conditions as were present in the diseased animals at D'thala.

By the kindness of Colonel Bruce, R.A.M.C., I was enabled to compare Dr. Watkins-Pitchford's description of the morbid anatomy of this disease as observed in Natal. I found all the morbid conditions described by Dr. Watkins-Pitchford, save the changes in the marrow of the femur, which I was unable to see, owing to lack of instruments. The blood of some of the diseased animals was examined microscopically by Major Smith, the Parel Laboratory, Bombay, and myself, with negative results in every case. Cultures and inoculation into a mouse and a guinea-pig, with some blood obtained by me from diseased animals, were made at the Parel Laboratory, Bombay, with negative results. Major Smith had previously seen this disease in South Africa and had no hesitation in identifying it. The acute pulmonary form of the disease was relatively infrequent, but I was able to obtain a photograph of a mule after death showing the characteristic froth at the nostrils. This photograph is similar to the one reproduced in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. vii., September, 1906, p. 241.

A considerable amount of evidence has been brought forward to show that this disease is probably carried by Anopheles mosquitoes. It is curious that this disease appeared in D'thala at the height of the mosquito and fever season, and commenced in Shaikh Othman and Khormaksar shortly after the beginning of the mosquito and fever season in these places. In D'thala, Anopheles mosquitoes appeared on August 5th, 1906, and increased steadily in numbers up to the end of September, gradually diminishing in numbers after that date, until, when I left D'thala on November 7th, only one or two Anopheles could be found. In Shaikh

Othman and Khormaksar, Anopheles usually appear in October (Captain W. S. Patton, I.M.S.), and when I arrived at Shaikh Othman on November 24th, Anopheles mosquitoes abounded there. If the infection be conveyed by an Anopheles mosquito it must be carried by the *Anopheles arabiensis* (Patton), since this is the only species which is numerous in all the places where the disease appeared. Unfortunately, an experiment of isolating 2 mules in mosquito netting proved abortive owing to lack of supervision.

I had some difficulty at first in understanding how the disease was conveyed from D'thala to Lakej, as the Arabs possess extremely few horses and mules, and none were permitted to leave D'thala. However, I found that a couple of donkeys died near D'thala during October, and it is known that donkeys can suffer from South African horse-sickness in a mild form. Now donkeys are very common beasts of burden in this part of Arabia, and were continually going from D'thala to Lakej and Shaikh Othman. I think, therefore, that the infection was probably carried by donkeys from D'thala to Lakej and Shaikh Othman.

In conclusion, I wish to thank A. S. Meek, Esq., Transport Officer at D'thala, Major Jacob, Political Agent at D'thala, and Captain Hancock, first Assistant Resident at Aden, for the information they kindly placed at my disposal.

THE TREATMENT OF GONORRHŒA IN THE ARMY.

By Major H. C. FRENCH.
Royal Army Medical Corps.

It not infrequently happens that men are admitted to hospital a month or two after arrival at their station either with a relapse of gonorrhœa, or with intractable gonorrhœal complications, such as stricture, epididymitis, and orchitis; and sometimes with arthritis, or eye affections, the result of "systemic" infection. Gonorrhœa is a potent cause of anæmia and debility, and when excessive smoking and beer-drinking is superadded, of that typical affection of soldiers, "disordered action of the heart." Endocarditis may occur in the course of gonorrhœa, in conjunction usually with arthritis, or a generalised septicæmia. If a man, in the first instance, is adequately treated in hospital for gonorrhœa, these complications are less likely to occur, and invaliding is correspondingly reduced. Many soldiers, however, go about with gleet for months, and only report sick, either when complications such as arthritis occur, or when awarded punishment for military offences, when they often make use of it after award to evade sentence of court martial, and they commonly succeed in their object. Treatment in hospital should continue for at least six weeks, whether the man says the discharge has stopped or not, unless microscopic examination of the urine shows an absence of the gonococcus, which is in the highest degree unlikely within the above-mentioned period. There are four advantages in the above minimum time-limit procedure. First, from the exact and recorded observation of many hundreds of cases, cessation of urethral discharge was commonly effected. Secondly, relapse in average cases more rarely occurred; this quite apart from the fact whether injection or irrigation was or was not used in freshly contracted cases. Thirdly, the occurrence of the previously mentioned protracted complications are lessened, or can be more promptly and adequately dealt with, and so the number of re-admissions are reduced. This ultimately reduces time in hospital, minimises loss of efficiency, and reduces invaliding. Fourthly, the "disciplinary" restriction, if concealment is frustrated, which it can be by properly directed effort, is beneficial in two ways. Many men, unless due for the Army Reserve, &c., wish to get out of hospital to avoid loss of pay,

hospital fatigues, &c. They are consequently not so liable to expose themselves again. The hospital fatigues, however, in large military stations, should not be so exclusively done by venereal patients. Fatigues such as scrubbing floors, or other heavy work, cause complications, buboes, swollen testicles, &c., and tend to promote concealment of disease before admission. If cured, men cannot later make use of a gonorrhœa to evade punishment. A gleet, or chancre, is a valuable asset to a soldier desirous of evading the result of irregularities, viz., punishment. Gonorrhœa cases should not be treated in syphilis wards, nor syphilis in gonorrhœa wards. The following tabulated rules form a rough general guide, reduce clerical labour, and simplify ward work in dealing with large numbers of gonorrhœa cases with a small staff. A copy can be posted in a conspicuous place in the ward.

(1) All cases on admission will have two No. 9 pills, and later mist. alba, $1\frac{1}{2}$ ozs., every morning for seven days, or until the treatment is changed by the medical officer in the book.

(2) Mist. alkaline, 1 oz., t.d.s., for ten days, or until the treatment is changed by the medical officer in the book. If there is much scalding, or chordee, the medicine can be given every four hours, and a hot bath twice daily.

(3) No injection, or irrigation, until ordered in the book by the medical officer.

(4) Bed, except for necessary purposes, until marked "up" by medical officer. This includes absolute exemption from hospital fatigues, which is often not the case at present.

(5) A piece of clean lint, or cotton wool, soaked in 1 in 2,000 perchloride of mercury, will invariably be kept on the penis between the glans and foreskin, changed frequently and placed in a special basin.

(6) The patient must be careful that he does not touch his eyes with the discharge, or he may lose his sight.

(7) Under no circumstances will a patient with pain in the testicles, or groin, or with swollen testicles, inject or be irrigated, except with the medical officer's permission. The orderly carrying out irrigations should be so warned.

(8) Cases of *relapse* of gonorrhœa re-admitted to hospital will be recorded as such on their diet sheets in red ink, with the date of their previous stay in hospital, and enquiry elicited as to "the cause."

(9) Cases of gonorrhœal complications, such as epididymo-orchitis, arthritis, stricture, &c., should be entered in red ink on

the diet sheet, and on a "gonorrhœal case-sheet," which is filed for reference. The accurate collection of such data is invaluable. Cases of epididymo-orchitis, on an average, remain eight to twelve weeks in hospital.

(10) Two hip baths are kept in the ward for "acute" cases of gonorrhœa, or cases with swollen testicles, specially ordered hot baths. The bath daily used by "convalescing" gonorrhœal cases will be indicated in the bathroom by a notice board.

(11) The wardmaster, or orderly, in the ward, will read the above orders to each patient on admission, and will report the next day to the medical officer in charge of the ward that this has been done.

The above rules are framed to guard against initial neglect in the acute stage by the patients, or orderly, since inattention to minutiæ, or neglect, is ordinarily a common cause of epididymo-orchitis, &c., and of a prolonged stay in hospital.

I consider that cases of gonorrhœa in hospital should be marked "bed" during the "acute" stage, that is, about seven to twelve days. Milk or "farinaceous" diet, with barley water, porridge, and cocoa as extras. During this period, free saline purgatives are administered every morning, and mist. alkaline every four hours. No injection. This dietetic and sedative line of treatment usually prevents chordee and pain, and better guards against "systemic" infections, such as myalgia, septicæmia, and gonorrhœal rheumatism with or without effusion, and protects against intractable complications, such as prostatitis and epididymo-orchitis, due to backward extension. After ten days, on an average, under this treatment, the formerly creamy, yellow, purulent discharge becomes thinner, whiter, and muco-purulent. The man may then be marked "up" and his diet changed to convalescent. Alcohol, spices, and much meat prolong the duration of the discharge.

On admission to hospital, after microscopical examination of the purulent discharge, the urine of each man should be subjected to Thompson's two-glass test bi-weekly, or daily in some "acute" cases, and the diagnosis of anterior or posterior urethritis, as the case may be, is made from this rough clinical test in order to select which kind of irrigation is to be made. The "first" morning urine is passed, half into one glass, half into the second. The glasses are labelled 1 and 2. The urine is passed in the presence of an orderly, and can be kept, if necessary, in the ward annexe, to stop humbug, such as the substitution by the patient of a normal urine. If the urine in No. 1 glass (*i.e.*, the first passed) is "cloudy," and that in

No. 2 glass is "clear," the case is one of anterior urethritis, the diet sheet is thus marked, and irrigations for *anterior* urethritis are commenced. If the urine in No. 1 glass is clear and that in No. 2 is cloudy, or both are cloudy, the case is one of posterior urethritis, the diet sheet is marked "posterior," and irrigations for posterior urethritis are commenced *as soon as acute symptoms have subsided.* Should cystitis or epididymo-orchitis threaten, or occur, injections or irrigations should entirely cease. Sub-acute cystitis, or prostatitis, may be recognised by the "ropy" appearance of the urine, with large deposit, or by blood in urine (smoky) if acute, and in both glasses if acute, or in the second glass, when sub-acute. Pain over the region of the bladder is usually complained of, and is relieved by fomentations every two hours.

"*Anterior*" irrigation commences about the fourth to sixth day, unless orchitis, cystitis, or other contra-indication is present. Anterior irrigations, one pint at a time, can be employed, two, three, or more times daily—but posterior (which enter the bladder) are naturally much more severe, should be more cautiously employed, and never more than once a day, preferably in the morning. An "anterior" irrigation (half a pint) to wash out the anterior urethra, is first made before giving a posterior irrigation (half a pint). It is useful in posterior cases to give a second "anterior" irrigation in the afternoon, and the last thing at night. In selected cases a man could carefully syringe in the intervals, or be more frequently irrigated.

The irrigations are performed by a properly trained orderly under the direction of an officer. Kolman's dilator may be used in chronic cases with irrigations. This instrument, by expanding, dilates and stretches the mucous crypts, and thus permits the "free" gonococci and pus organisms to be washed out of these crypts.

A solution of permanganate of potass., 2 grs. to 1 oz., and 1 oz. of this to every pint of luke-warm water (90° to 95° F.), is used for irrigation. The strength, therefore, is gr. to 1 oz. The strength can be later cautiously increased. Silver salts are apt to cause cystitis, and should not, I consider, be used until the "gleet" stage in the third or later weeks, but the advantages of silver salts are theoretical rather than practical. My predecessor at Woolwich (Major Eckersley), abandoned them, I understand, owing to the frequency of orchitis and cystitis; I saw them resumed, and later abandoned. They should, I think, be limited to "anterior" irrigations or injections in the later stages in

experienced hands. Gonorrhœa, like syphilis, has a natural tendency to resolve. Silver salts are apt to be credited with the success primarily due to nature, *i.e.*, phagocytosis, as later explained. About 8 pints of the irrigating solution is placed in a large "measured" glass receptacle, which is hung on the wall about 8 feet from the ground, the solution coming through the india-rubber tube affixed to the bottom of this glass receptable.

The distal end of the rubber tubing is fixed to a "double channel" irrigation glass nozzle. The orderly sits on a stool opposite to the patient, and inserts the point of the glass nozzle just inside the urethra. Over the penis is a mackintosh apron to direct the fluid into a bucket. The orderly should wear india-rubber gloves. The glass nozzle of the irrigating apparatus is sterilised before use, and should be disinfected by dipping in 1 in 20 carbolic lotion between each case.

After *posterior* irrigation the patient empties his bladder into a glass and shows it. It can be noticed, that as the case improves the colour of the permanganate of potassium solution is retained.

The apparatus is obtainable at the Army Medical Stores, Woolwich, viz.: Large urine glasses, two per man; large glass measured pints, double channel glass nozzle, india-rubber tubing. Mackintosh for aprons from Barrack Stores.

After the urethral discharge has ceased, the urine, as evidenced in the urine glasses, gradually becomes clear, and threads, in average cases, are no longer visible after five to six weeks. The man is then placed on beer for several days, and if the urine still remains clear he is discharged hospital when ten or fourteen days free of discharge, if the gonococcus is not demonstrated by the microscope, but never under six weeks if admitted with "acute" gonorrhœa. This time limit better guards against later relapse, and further medical inefficiency from irregular habits outside.

The only really scientific treatment of the "gleet" stage in chronic cases which curtails it, is to illuminate the urethra by means of an electric urethroscope, any time after the twentieth day of disease, if the discharge is gleety, or in chronic cases, and apply local applications of argent nit. to the "granular patch," present at some time in every case of freshly contracted gonorrhœa. This patch usually causes the persistence of the glairy gleet, or may give rise to stricture. By means of this instrument, with practice, it is quite feasible to detect the presence of the exquisitely tender "granular patch." If the urethra is unduly sensitive at any one spot on the passage of the instrument, one is then quite certain that

the gonorrhœa is not cured. In the case of a "normal" urethra, there is no pain or discomfort on the passage of the instrument. In a "diseased" urethra the granular patch is usually situated within 4 inches from the meatus urinarius and on the floor of the urethra. In cases of prolonged gleet a more careful examination should be made for stricture, or for enlarged prostate. If the latter, massage of the prostate may be tried, as in America. Before a case of gonorrhœa is discharged from a military hospital a careful examination of the meatus urinarius should invariably be made. If the meatus is red and glazed, discharge is present, in despite of the man's assertion to the contrary, with a view to getting out of hospital and so avoiding loss of pay. Swab the urethra with a piece of cotton wool and examine for gonorrhœa, or examine the urine for the gonococcus, if the man states that there is not any discharge. The groin should be examined for tenderness, or possible glandular enlargement, and the testicles and epididymis for tenderness, or possible epididymo-orchitis. The urethral mucous membrane should be closely examined by the urethroscope to see if the "granular patch" on the floor has resolved. Failing the possession of this invaluable instrument, a black vulcanite urethral canula, with sharp edge and solid interior plug, which can be withdrawn, is supplied by the "Icthyol Company," High Holborn, London. It is a simple and excellent instrument for localising the "granular patch" and topically treating it. If the man feels any pain or tenderness on the passage of the anterior sharp edge of this instrument, a "granular patch" must exist on the floor of the urethra, and, *ipso facto*, a gleety gonorrhœal discharge must be present. Cases should be inspected once a week for a month after discharge from hospital. The urine can be centrifuged and microscopic examination made for gonococcus before declaring the case cured. Finger, of Vienna, also considers that six weeks is the usual period of gonorrhœal discharge, and that injections do not curtail this period. When relapse occurs the case should be at once sent for adequate treatment to guard against "complications," debilitating anæmia, and the infection of others. Relapse, in carelessly-treated gonorrhœa, may nearly double the admission ratio of gonorrhœa cases. An admission and discharge book kept in the ward, or a gonorrhœal case-sheet, when properly kept up, gives very material assistance to the medical officer in charge of the hospital in compiling his annual report on venereal diseases. The "causation" of intractable complications, such as bubo, in the case of gonorrhœa complicated by balanitis, or by venereal sores, and of

epididymo-orchitis, bubo, and gonorrhœal rheumatism in the case of gonorrhœa, are recorded in it. Cases of gonorrhœa complicated by the occurrence of arthritis, epididymo-orchitis, or anæmia, should, on discharge from hospital, be kept under special observation for endocarditis. A notification should be sent to the medical officer in charge of the barracks. The above complications commonly indicate a constitutional or severe infection, and are usually associated with fever at the onset, and later, with severe and often prolonged debility and anæmia, which predispose to other diseases. This, in many instances, more especially at foreign stations, permanently incapacitates the men, and renders later invaliding necessary. Further, when it is considered that orchitis is the commonest cause of "sterility" in the male, that iritis may cause permanent damage to the eye, and that gonorrhœal arthritis often leaves permanently stiff or useless joints, the importance of attaining accurate knowledge of these complications cannot be under-estimated. Permanent adhesions usually form when arthritis is inadequately treated. The prognosis, however, is good, if the case is seen early and well treated.

Quite apart from the humanitarian aspect, it would appear that the interests of discipline are better maintained in the case of prisoners suffering from venereal diseases, if a regulation directed that all such cases in the first instance are to be invariably admitted to hospital and not first sent to prison. Such time as is thereby lost to be made up in prison on recovery. This procedure would, it is believed, absolutely prevent concealment, commonly practised by soldiers with the ulterior view of evading awards of courts-martial, and discipline would be more adequately safeguarded. Hard labour and physical exercises will rapidly induce epididymo-orchitis, and prison life and food will markedly accentuate the debility and severe anæmia that ordinarily occurs in the course of this disease.

Remarks.—I do not concur in the view put forward by Major Pollock, R.A.M.C.,[1] that irrigation in the initial acute stage of gonorrhœa prevents the posterior urethra from becoming infected. I consider that chemical irrigation or injections, in the early stage, so far from preventing, are very liable indeed to cause infection of the posterior urethra, and in the very *acute* stage are probably quite the most common cause of undesirable complications, such as

[1] "Treatment of Venereal Diseases in the Army" (Advisory Board Final Report, p. 15).

epididymo-orchitis, cystitis, urethral fever, and "systemic" infection. Notes could be given of very many cases. Thompson's two glass test shows that subsequent to irrigation the posterior urethra has become involved, whereas it may not have been so before. Rest in bed, milk diet, hot baths, hot compresses, sedative alkaline mixtures, free saline purgation, and an absence of hospital fatigues, are much more reliable remedies in preventing these intractable complications, and this view is, I believe, supported by the experience of the profession at large and conservative medical opinion. I have extensively tried both plans amongst some 5,000 in-patients, but in the initial "acute" stage have long abandoned chemical irrigations and injections in favour of more conservative methods, and with the best results. I consider, especially in dealing with ignorant patients, that it is a retrograde step in our knowledge to unduly interfere with an intensely inflamed urethra in the very early stages, either by instrumentation, or chemical injections or irrigations, which often act like instrumentation, and give rise to urethral fever and its adverse sequelæ.

The posterior urethra is not uncommonly affected at the time a patient reports sick, and the not infrequent presence of epididymo-orchitis at the time of admission to hospital, which is usually due to delay in reporting sick—*i.e.*, concealment, or injection at the local chemist's—should preclude routine irrigations or injections until the case is more closely studied. Hence the importance of a few general instructions as given in the beginning of this article. After epididmyo-orchitis, or cystitis, has been present, if chemical injections or irrigations, are used, severe relapses of the former condition very often ensue—and these conditions commonly mean a stay in hospital for three months before the man is fit for military duty, whereas, if complications do not ensue or persist, a man should be quite fit to attend as an out-patient confined to barracks after five weeks in average cases. The fact, moreover, of the testicle swelling as a result of too early or vigorous irrigation in hospital, is apt to discredit the treatment in the eyes of the patient, a desideratum of the first importance in the Army, where soldiers are only too ready to resort to quacks and chemists. Discredit is thus unfairly thrown on irrigation, which, with limitations, is an advance on the injection treatment.

I have tried, and have seen used, all the ordinary chemical injections and irrigations, and favour, once the acute symptoms have abated, sterile warm water to commence with, followed by potass. permang., in dilute solution, $\frac{1}{10}$ gr. to 1 oz., as an irrigation,

and ½ a drachm to 2 pints of water as an injection, and the strength increased in the gleet stage. The reason why injections and irrigations fail to more appreciably curtail the total duration of a gonorrhœal discharge, even amongst in-patients, is presumably due to the pathological fact that the gonococci, besides gaining an entrance into the leucocytes as a result of phagocytosis, also gain an entry into the urethral sub-mucous connective *tissue*, and give rise later in the gleet stage to the "granular patch." The superficial mucous crypts in the urethral lining membrane no doubt also lodge the gonococcus; but the persistence of gleety discharge is probably due to the minute though definite *infiltration* (granular patch) in the sub-mucous coat, which only slowly proliferates and resolves, or later in rare instances, in neglected chronic cases, forms a thickening or stricture. Irrigations, injections and diuresis, in muco-purulent stages, wash away the accessory pyogenic organisms, pus corpuscles, and some of the free gonococci, but could not remove gonococci imbedded in the tissues until sufficient time had elapsed for exfoliation of the surface epithelium, which occurs naturally during the course of resolution of the localised inflammation. This observation is further borne out by the clinical fact that cases of stricture are commonly found in association with a prolonged urethral discharge. There is also a resilient slight enlargement of the inguinal lymphatic glands in many cases of gonorrhœa, and the leucocytes containing gonococci can thus get into the blood stream and give rise to constitutional symptoms, such as anæmia, arthritis, fever, or generalised septicæmia. Hence the scientific treatment of the unduly prolonged "gleet" stage which guards against complications is that so ably described by Mr. Burghard[1] by means of the electric urethroscope, and local applications to the "granular patch" of a strong solution of argent nitratis (grs. xx. to grs. xxx. to the oz.). A large number of gonorrhœa cases, of course, naturally get well after five to seven weeks without any local treatment. This is what we would expect of a localised inflammatory process—provided we prevent a generalised septicæmia occurring—by rest, dietary, diuresis and sedative measures in the initial acute stage, and careful irrigation or injection later.

Carefully safeguarded irrigations performed by a trained person are necessarily more efficacious in the "muco-purulent and gleet stages" (*i.e.*, later stages), than routine injection practised by an

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[1] King's College Reports, vol. i., 1893, p. 115.

ignorant patient. After the third week, the "frequency," time, and manner of irrigation or injection, and not the chemical nature of these, is no doubt one dominant factor in curtailing the discharge in average cases if the phagocytic power is normal. I have pursued investigations in India, extending over some hundreds of cases, where no injection or irrigation, was ever used. I was astonished at the infrequency of complications, and the ordinary duration of urethral discharge was five to six weeks.

I believe that at the Guards' Hospital, London, a similar series of investigations was conducted ten years ago by Colonel Fenn, R.A.M.C., at the instance of Mr. G. Lenthal Cheatle, and the latter informed me that the duration of urethral discharge averaged about five weeks.

Of course one is met with the admitted fact that there are prolonged cases of gleet that last much longer, and that threads may be seen, or gonococci may be recovered from the urine, after three months, but in some cases only pus corpuscles and not gonococci are found. I cannot admit that irrigation, even for several months, does much good in many of these prolonged cases, although it has been advocated as the universal panacea. It is in this class of case, or in the case of men who frequently contract gonorrhœa, that stricture not uncommonly results. There is often a history of several previous attacks of gonorrhœa. In some of these cases the urethral discharge persists for fourteen weeks or longer, in despite of most carefully supervised irrigation (including silver salts), and in-patient hospital treatment. Naturally, when a posterior urethritis, or epididymitis, has occurred, the average duration is ordinarily much longer (eight to twelve weeks on an average) than in uncomplicated anterior cases (five to seven weeks), so that it behoves us to prevent, if possible, the occurrence of these conditions. I consider this is best done by ensuring that the man reports sick early, before his testicles swell, and that he is first treated in hospital. If a soldier with gonorrhœa only reports sick when his testicle has swollen, and he is consequently unable to walk, he ought to be crimed with concealment. The disease has probably been in existence seven to ten days, and the chemist has fialed to cure him. I have used, and have seen extensively used, urotropine and salol as urinary disinfectants, but, like silver salts, the advantages in practice are not so obvious as well advertised; and barley water, by increasing diuresis, effects excellent results. Tonics, particularly quinine and iron, improve the anæmia ordinarily present in the later phase of gonorrhœa, and, *ipso facto*, may cur-

tail the duration of gonorrhœal discharge by increasing the phagocytic power of the individual. Recently, antistreptococcus serum is advocated for gonorrhœa. I have not as yet had any experience of this line of treatment. The injection is made *per rectum.* Concealment of disease results from indiscriminate punishment, but disciplinary efforts, if properly directed, can easily prevent the concealment. If treated as "out-patients" after five or six weeks in hospital, cases of gonorrhœa must be confined to barracks, and excused the canteen to stop drinking under Army Order 158 of 1903. This tends to prevent the infection of women in the neighbourhood, and the consequent re-infection of their comrades in the garrison. In civil life, all cases of gonorrhœa are treated as out-patients.

The prolonged and worst cases of gonorrhœa, like syphilis, ordinarily result from initial neglect, concealment, and treatment by the prescribing chemist and civil medical practitioners. The latter should be obliged to notify cases of venereal disease to the military authorities, as on the Continent, since soldiers can only be temporarily—and consequently inadequately—treated under such circumstances; and the expense to the public is considerably and quite unnecessarily increased by reason of a more prolonged stay in hospital due to initial concealment, and easily preventable factors. There is not at present any "systematised" procedure in dealing with concealment in the Army. Reports are only made in a small percentage of cases, and the punishments vary. If concealment reports are to be regularly made by medical officers, the soldier should be more regularly warned in barracks by his commanding officer, and when one case of concealment occurs in a company, every man in that company should be medically inspected. No punishment should be awarded, except for concealment of venereal disease. Non-commissioned officers should attend, or be seen separately from the men, and treated, if possible, in separate wards.

Clinical and other Notes.

NOTE ON VON BERGMAN'S OPERATION FOR HYDROCELE.

By Lieutenant-Colonel J. R. FORREST.
Royal Army Medical Corps.

It is laid down in the text-books (Treves, Rose and Carless) that the whole of the parietal layer of tunica vaginalis, including that portion covering the cord, should be removed. I recently performed the operation on a man in whom the tunica vaginalis was moderately thick. I removed the whole of the parietal layer, cutting with scissors as close to the testis as possible, but *leaving the layer covering the cord untouched.* The wound healed by first intention, and there has been to date (three weeks since operation) no recurrence of hydrocele fluid. I think it is worth noting that interference with the cord is unnecessary, as it greatly facilitates the operation, and is, I think, more likely to lead to a satisfactory result if the cord is left alone.

A CASE OF CARCINOMA OF THE LIVER IN A MAN AGED 24.

By Captain O. IEVERS.
Royal Army Medical Corps.

Primary carcinoma of the liver being so rare a condition, the following case, which occurred recently at the Station Hospital, Wynberg, Cape Colony, may be of interest.

Private B., R.A.M.C., aged 24, with five years' service, was admitted to hospital on February 7th, 1906. His chief trouble was a short, irritating cough, which kept him awake at night; but he also suffered from loss of appetite and pain in the right side. He states that he had always been healthy and strong up to six weeks before his admission to hospital. During December, 1905, he began to lose his appetite and to suffer from pain in the right side and back, and later the cough developed; he also began to lose weight and to feel generally unfit. As regards his family history, his mother and one sister died of phthisis, and his father of heart disease.

On admission the patient looked thin and ill. Pulse 76. Temperature 98·2° F. in the morning, 100° F. in the evening. On examining the thorax, râles and coarse ronchi could be heard all over both sides. There was a well-marked friction sound at the right base and less marked at the left base. The heart sounds were weak, but there were no signs of organic valvular disease. The abdomen was distended and tender. The

liver could be felt enlarged and tender beneath the costal margin, the liver dulness being increased to 1½ inches downwards. The edge of the liver was well defined, and as far as could be felt the surface was smooth and even. There was dulness in both flanks, and a fluid thrill could be felt from one flank to the other. The umbilical region was resonant. There was no sign of glandular enlargement, no œdema of the feet, and nothing abnormal could be detected by rectal examination. The urine was normal. The sputum was examined for tubercle bacilli, but none could be detected. The patient was ordered a fluid diet, and an expectorant mixture, which latter, as the cough became better, was substituted by caffeine and digitalis.

By February 24th the fluid in the abdomen had increased, the temperature was of an intermittent type, and the patient was beginning to suffer discomfort and respiratory embarrassment. Consequently it was decided to open the abdomen. This was accordingly done by Lieutenant N. D'E. Harvey, R.A.M.C., under whose care the patient was at that time. Chloroform was administered, and an incision three inches long was made in the middle line of the abdomen below the umbilicus. About 5½ pints of clear yellow fluid was let out. As far as could be seen the peritoneum and intestine were healthy in appearance. The wound was closed and subsequently healed by first intention.

For the next few days the patient improved, the temperature did not rise above the normal, and the discomfort and pain were diminished. Fluid, however, again collected in the abdomen, and on March 6th 5 pints were withdrawn through a Southey's tube. The ascitic condition now became severe and persistent, necessitating frequent tappings; the enlargement of the liver downwards increased, the patient became weak and emaciated, and the conjunctivæ had an icteric tinge. During the week from the 21st to 28th March, over eleven pints of fluid were withdrawn from the abdomen, and bile was detected in the urine.

On March 29th the patient was restless and inclined to be delirious, the conjunctivæ were more yellow, and the urine very dark in colour, owing to the presence of bile. The temperature remained normal, the pulse varied from 80 to 100 and the respirations 25.

For the next two days the condition became worse; the patient became semi-unconscious, gradually sank, and died on April 1st.

At a *post-mortem* examination the pleura was very adherent at both bases, especially at the right base, where the two layers could be separated with difficulty. There was also congestion of the bases of both lungs. The valves of the heart were stained yellow, but otherwise the heart was healthy. The peritoneum was smooth and not congested. The liver was much enlarged and weighed 88 ounces. Small, hard nodules, convex in outline, projected to the surface, which was uneven and of a dark greenish colour. On cutting into the substance of the liver, a large, hard, yellowish-white mass was found in the upper part of the right lobe, extending

right through the substance of the liver, and involving the portal vessels in the portal fissure. Studded through the rest of the liver were numerous similar, but smaller, growths, varying in size from a pea to a walnut. The other abdominal organs were healthy. Sections of the growth were kindly cut for me by Dr. Robertson, Medical Officer of Health for Cape Colony, and showed the nature of the growth to be one of spheroidal-celled carcinoma. There was a great deal of fibrotic change, and the cells of the proliferating epithelial masses were smaller than those of the other forms of hepatic carcinoma, only the nuclei taking the stain deeply.

The chief clinical interest was that the family history, the cough, pleuritic friction, and the fluid in the abdomen, pointed strongly to tuberculous disease, later the hepatic enlargement, bile-stained conjunctivæ and urine, and the persistence of the ascites, suggested some growth in the liver involving the portal fissure.

AN EXTEMPORISED SUPPORT FOR INFLAMED OR ENLARGED TESTICLES.

By Lieutenant-Colonel T. Du B. WHAITE.
Royal Army Medical Corps.

On page 33 of the "Third Report on the Treatment of Venereal Disease and Scabies in the Army," a description is given of the Horand's suspensory bandage, and this leads me to call attention to a device I have been in the habit of using for some time to give support to inflamed or enlarged testicles. The suspensory bandages usually supplied are far too small for the majority of cases, and the need for a roomier and more comfortable support induced me to use a triangular bandage in the following manner.

At a point eight inches from the long border of the bandage, cut a slit parallel with the border and just large enough to admit the scrotum and penis; tie the folded border round the pelvis so that the lower edge of the aperture is well up in the perineum. Now raise the point of the bandage, mark where the root of the penis comes, and there cut a small round hole for the penis. The support is completed by passing the penis through the last hole, and pinning the point to the waist band with one safety-pin. Two pleats are needed to get the necessary adjustment, and cotton wool, either plain or medicated, graduates the pressure and makes a comfortable bed for the inflamed organ.

The advantages over the Horand's suspensory bandage are: (1) It is easier to make, as no sewing is required; (2) it is more comfortable than Horand's, which is not really a suspensory bandage at all; (3) there are no strings passing between the patient's legs, and a man can go to stool wearing my contrivance without disturbing the dressings.

Major H. A. L. Howell, R.A.M.C., informed me that a patient with

some experience in these matters, and who had formerly been under my care in the Surgical Division for radical cure of hydrocele, insisted on being supplied with a similar appliance when his other testicle became inflamed from a different cause.

RECURRENCE OF MALTA FEVER.

By Lieutenant-Colonel G. CREE.
Royal Army Medical Corps.

This case is illustrative of the length of time that Malta fever may lie dormant in the system and then make itself felt.

Private M., 2nd Suffolk Regiment, was admitted to the Station Hospital, Bellary, under the care of Lieutenant R. R. Lewis, R.A.M.C., on January 16th, 1906, and developed what was, clinically, Mediterranean fever. He remained in hospital, and suffered from three distinct waves of fever, till March 20th, 1906, when he was transferred to Wellington as a convalescent. His blood was sent for Widal's reaction on January 26th, 1906, and gave no reaction to enteric, nor were there any malarial parasites found in his blood. A few days after his arrival here the blood was again taken and sent to Kasauli, the result being "a distinct reaction to *Micrococcus melitensis* in a dilution of 1 in 20."

His medical history sheet shows as follows: an admission for Mediterranean fever on October 14th, 1897, whilst at Malta, which lasted forty-four days. This was preceded by an admission for simple continued fever, lasting eight days, from June 30th, 1897, to July 7th, 1897, and followed by another admission for the same disease, also lasting eigh days, from January 14th, 1898, to January 21st, 1898. From this date he was free from fever till September 27th, 1902, when he is shown as admitted for ague, whilst at Karachi, also lasting eight days, and a second attack of ague on June 11th, 1903, when in Hyderabad, Scind, which lasted five days. There is no record of the malarial parasite having been found in either of these instances. From the date of this last admission for ague till the admission in Bellary for the illness under consideration, he had no admissions for any form of fever, and presumably was in very good health.

POST-ENTERIC THROMBOSIS, AND ITS TREATMENT BY CITRIC ACID TO DISSOLVE THE CLOT.

By Lieutenant-Colonel E. J. E. RISK.
Royal Army Medical Corps.

Remarks.—Post-enteric thrombosis is almost always produced by the local effects of micro-organisms. Thrombosis is generally attributed to one or more of four causes: (1) Feeble circulation; (2) some injury or

alteration to the intima of blood-vessels; (3) intrusion of foreign matter into their lumen; (4) some alteration in the blood itself, leading to hyperinosis, or a marked tendency of the blood to form clots.

Hyperinosis is increased by carbolic acid, ether, chloral hydrate, lime salts, diet rich in proteids; potable waters rich in lime salts; diet of milk. Milk contains ½ gr. to the ounce of lime salts, *i.e.*, more than the liquor calcis of the *British Pharmacopœia*.

Hyperinosis is decreased by a rise of temperature, use of citric acid, sodium citrate, whey and cream, fresh lemonade; free use of H_2O in enteric (Osler); well-prepared green food, and a diminution of proteids, or a purin-free diet.

Last year, out of fifteen cases of enteric fever at Bloemfontein, one alone suffered from thrombosis. All cases were treated by 5 minim doses of ol. terebinth, t.d.s., and a diet of milk freely diluted with barley water. Most of the patients also had one or two pints of lemonade daily during the pyrexial stage, supplemented in the third and fourth weeks by Benger's food and beef tea when necessary. They had, therefore, plenty of fluids, although not the quantity used by Osler in the Johns Hopkins Hospital, where water to the extent of six to seven litres is pressed upon the patients daily, with a minimum of three litres.

I am inclined to think the general freedom from thrombosis is due to the use of lemonade and free dilution of milk. I gather that in the Military Hospital, Pretoria, lemonade is given as a routine to all enteric cases, with the result that very few cases of post-enteric thrombosis occurred during 1906, and these not of a severe type.

Our patient, then, on the twenty-ninth day, and after an apyrexial period of ten days, first felt pain in the calf of his right leg and the popliteal region, this phlebitis being followed by extension up to the groin, the foot, leg and thigh becoming immensely swollen by the third day after the initial pain. The internal saphenous vein was hard and painful to touch from foot to groin. On the fourth day the circumflex iliac vein became affected, hardness and œdema extending three or four inches above Poupart's ligament. The leg and thigh were placed at once in a boracic acid poultice, and bandaged lightly up to the limit of the œdema. On the third day after the pain commenced, I ordered citric acid in solution, grains three, six times a day; on the eighth day the pain ceased, and by the fourteenth day the leg was equal in size to the other. This appears to be a small dose to have this effect, and I should like to learn from brother officers their experience in this matter.

Sir A. E. Wright and Sir Dyce Duckworth, to whom I am indebted for this idea of treatment, the former in the *Lancet* of October 14th, 1905, and the latter in the *St. Bartholomew's Hospital Reports* for 1905, state that half a drachm dose of citric acid, well diluted, several times a day (as Wright states), decalcifies the blood.

This idea opens up a wide scope for treatment of gouty phlebitis, thrombosis, and the phlegmasia dolens of parturient women, and if it

acts as it appeared to do in this case, it is a most valuable and striking remedy. It would appear also that as long as there is danger of intestinal hæmorrhage in enteric fever, milk, containing, as it does, half a grain to the ounce of lime salts, should be given up to the limit of digestion, to produce a state of comparative hyperinosis, and promote the viscosity of the blood, say up to the third or fourth week, when hæmorrhage may occur, after which period it is the duty of the physician to prevent a tendency to thrombosis by either administering citric acid, freely diluted, or by some other measure, as before suggested, to diminish the tendency of the blood to clot, in other words to decalcify the blood in convalescence, and to calcify or increase the viscosity in the hæmorrhage danger period.

A COMBINED DIET- AND CASE-SHEET.

By Captain A. H. SAFFORD.
Royal Army Medical Corps.

The only alteration in the present form of diet-sheet I would propose is that the space at present allotted for change of diets be curtailed, and a blank space be left at the bottom for notes of the case. This form would only be used for minor cases, and is not intended to take the place of the case-sheet for the most serious ones. The junction of the diet-sheet and the blank space would be perforated, so that the latter could be easily torn off and filed, and on the reverse of this slip the name, rank, age, &c., of the patient would be noted. The space for diets on the present form of diet-sheets is not required, as the diet never requires changing daily.

[The diet-sheet is an Army Service Corps and not a medical document. There are obvious objections to the course proposed.—Ed.].

Travel.

A VISIT TO THE RUINS OF VIJAYANAGAR AND HAMPI.

By Lieutenant-Colonel C. W. THIELE.
Royal Army Medical Corps.

This is very easily done from Bellary, and the trip well repays one for the short time and discomfort (?) expended to see the remains of what was once the flourishing capital of the Vijayanagar Dynasty.

This was commenced by the Hindu King Deva Raya, or Harihara Devai, in 1336, and fell to pieces after the battle of Talikota, in 1565. Deva Raya was the late minister of Anegundi, who was raised to the dignity of chief of Anegundi by Muhammed Taghlag, of Delhi, a few years after that fortress, Anegundi, had fallen into his, Muhammed's, hands. The natural protection afforded by the surrounding mountainous country, and the plentiful water supply obtainable from the Tungabhadra River, must have had something to do with the fixing of this site for the old city, which became the birthplace and capital of an empire. The whole of it is dotted with bouldery hills of granite, with hardly a blade of grass on them.

The history of this interesting kingdom is given in "A Forgotten Empire"[1]: "Founded about the year 1335, it speedily grew in importance and became the refuge of the outcasts, refugees and fighting men of the Hindus, beaten and driven out of their old stronghold by the advancing Muhammedans. . . . If a straight line be drawn on the map of India from Bombay to Madras, about halfway across will be found the River Tungabhadra, which, itself a combination of two streams running northwards from Maisure, flows in a wide circuit north and east to join the Krishna, not far from Kurnool. . . . In the middle of its course the Tungabhadra cuts through a wild rocky country lying about 40 miles north-west of Bellary and north of the railway line, which runs from that place to Dharwar. At this point, on the north bank of the river, there existed, in the year 1330, the fortified town of Anegundi."

Bellary is on the Southern Mahratta Railway, about 38 miles to the west of Guntakal Junction, on the Bombay and Madras Railway, twelve hours from Madras and twenty-one hours from

[1] By Robert Sewell, late I.C S. Swan, Sonnenschein and Co., London, 1900.

Bombay. Hospet is the nearest railway station from Vijayanagar, and is about 40 miles west of Bellary, on the Southern Mahratta Railway.

Having come to Bellary, it was not long before we heard of the Hampi ruins, and naturally had a desire to pay a visit, but we postponed this until after the hot weather. It would well repay anyone having a taste for archæological curiosities to pay a visit to these interesting ruins, should they be within measurable distance of Bellary.

There is a traveller's bungalow at Kamalapuram, the present village before Vijayanagar, 8 miles by road from Hospet. We first secured the use of this for three days. Having arranged our commissariat for the above time, we left Bellary by the 9.30 a.m. train and arrived at Hospet soon after 12 noon. At this station we had quite a decent breakfast, though the beef was rather tough. It seems that quite a reputation had been established at this little railway station for affording good meals to travellers, but lately, for some reason, it has fallen off. At about 1.30 we started off in "bandies," the native conveyance, for the traveller's bungalow at Kamalapuram. The road is good, except in a few places, which sorely need the attention of the P.W.D., and as this was our first experience in this native form of conveyance, we got a good shaking, so were rather disinclined for much sight-seeing that day on our arrival at the bungalow at four o'clock. But after a wash up and refreshing tea, which was ready for us (we took the precaution to send our servants on an hour or so before us), we felt keen to go out and see something. Anyhow, there was Mr. Sabba Ramayya waiting to show us the way, and telling us that we could have a good two hours' look before dark. The bungalow is an old temple converted, and consists now of a large hall, two bed-rooms, a bath-room, and verandah on three sides, so can accommodate two couples. The sub-overseer informed me that it is the intention of the Government to add two more rooms on the top, as the influx of visitors to see these ancient ruins is increasing and more accommodation is needed. The charge is Rs. 1.8.0 a day for a couple, Rs. 1 for a single person. It is furnished, and one need only take bedding, towels, food and drinks.

Since Lord Curzon's visit to the place about three years ago, steps have been taken to do much excavating and repairs to the buildings effected for their partial restoration, as the efforts of the Mahommedans for their destruction were very effectual. This work is being carried on by the Archæological Department of the Govern-

ment of India, and some quite considerable sums have already been spent on the work, with good result. A few minutes' drive brought us to the east gate entrance to Vijayanagar. There is no gate now, but the site of entrance is shown by the square-cut pillars of stone on either side and the gap in the wall. One can see the remains of the double wall and ditch that surrounded the town; the latter is now a rice field.

The first place of interest we came to was the Queen's Bath. This in its time was a large roofed building about 50 feet by 30 feet and 6 feet deep. There is no roof now, but the walls are in a good state of preservation. There are galleries around on the inside and what might be called box seats, from which places the privileged could see the performances of the swimmers. Water for its supply was brought from the Tungabhadra, some 3 miles away, in stone aqueducts.

A little further on, on the left side of the road, we came to the large public swimming bath as it must have been; though only recently, as the result of much digging and taking out of tons of earth and *débris*, has this been revealed. This must be about 100 feet by 50 feet and 20 feet deep. Steps are cut on the sides for entering and leaving the bath. It was not evident how the water, after use, was got rid of. It was suggested that as labour was plentiful and cheap at the time, working parties were put on and the water bailed out. There was no roof to this.

The next place of interest we came to was the large pile which represents what was King Rany Raja's throne-house. The remains consist of a square, four-sided structure, with solid blocks containing bricks and earth in the interior. It is raised to about 20 to 30 feet. The base of what was the throne-house is reached by a flight of stone steps. These have been put into repair and one can go up and get a good view. On the four sides are carved representations of elephants, horses and soldiers. No remains of a roof or walls exist. Over against this, so to speak, is the arena, the place of public games, where I suppose wrestling matches and such like took place. This was a large roofed building, as evidenced by the square solid blocks, let into the ground at regular intervals, for the support of pillars, and brought to light by excavating. It is raised about 5 feet. On the east side are the remains of what must have been the main entrance. It is about 150 feet square, but I did not measure it.

Not many yards further along the road we came to the temple Hazar Rama Chendra Svami. This is in a fair state of preserva-

tion, and the main entrance and one or two other places have received the attention of the restorers to prevent further decay. It is a fine sample of Hindu temple and the carvings inside are good. It is low, as are all the Hindu temples, and has a tower made of brick, ornamented with many figures in various states of decay. The carvings on the nine black pillars in the central hall are beautifully executed. These pillars look like black marble, but I believe it was imported black stone. The carvings on the wall to the right are of note. They represent the story of Rama, his life and adventures and final journey to Ceylon in search of his wife Sita, who had been stolen from him by the Giant Ravana. "The whole series is the most noteworthy thing of the kind in the ruins, and, as has been said, is unique in this part of India."[1]

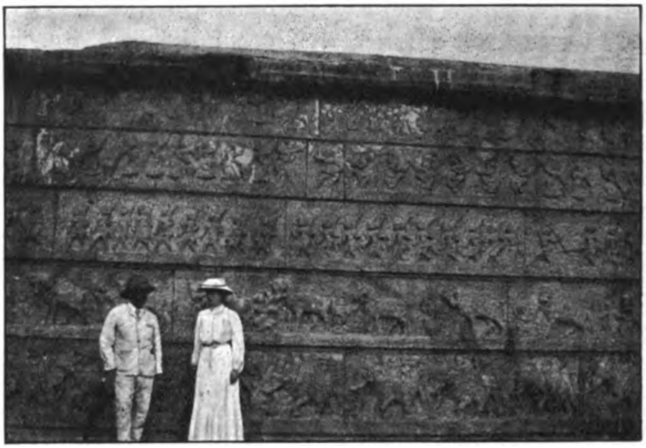

FIG. 1.—Hazar Rama Chendra Svami Temple. Wall from outside.

All around the outside walls of the temple, from the base to the top, are carvings, in tiers, representing from the bottom, elephant soldiers, horse soldiers, foot soldiers, women soldiers, and, at the top, dancing girls. Lying outside this temple is a large stone trough, hewn out of one solid block. It is 41 feet long, nearly 3 feet wide and 2½ feet deep. When dug out I believe it was the intention to have it taken to Madras, but in moving it a crack was made, and so it was decided to leave it here.

[1] "The Ramayana." Translated into English prose from the original Sanskrit of Valmiki. Balakandam. Edited and published by Manmatha Nath Dutt, M.A. Calcutta, 1892.

From here we went to the enclosure of the Council Hall and other State buildings. The wall is about 25 feet high, square in shape, and has four look-out and fighting towers, one at each angle. All are still standing. The Council Hall is a two-storied building, in a very good state of preservation. It is decorated in ornamental plaster. Stone steps lead to the upper storey. The surrounding earth has been dug out to the extent of nearly 6 feet to clear the base. Another structure remaining is a Zenana standing in a corner on the left of entrance, a very dark and gloomy place to pass one's life in. Outside the enclosure we saw the elephant stables, eleven stalls ("the other 789 of the king's elephants had to content themselves with humbler quarters"). These have domed roofs and arched entrances. At right angles to these stables is a large building, called the Theatre Hall. There is a belief among some natives that a considerable treasure remains hidden underground somewhere within this walled compound. Search has been made in several places, but no treasure has yet been discovered. Seeing that at the time of the fall of Vijayanagar into the hands of the Mahommedans and the death of the king, the princes trekked off with all the gold and precious things they could lay their hands on in the hurry, and which amounted to, it is said, 100 millions worth of gold, diamonds and precious stones, on 550 elephants, I should not think much of value was left behind.

By the time we had got so far the light began to fail, so we returned to our bungalow, well pleased with what we had seen and heard from our guide. Being rather worn out after a tiring day, we turned in soon after dinner, but not to sleep, as we hoped. We had been cautioned to put up mosquito nets, but being deceived by a cool breeze blowing, failed to do so. We paid the penalty by a sleepless night on account of the mosquitoes. Let this be a warning to others who might go to spend a night or more here—take nets and sleep under them. The place has a deserved reputation for malaria, and hunters about the district who fail to take the necessary precaution of sleeping under mosquito nets, are almost sure to get an attack of fever.

The next morning, after "chota hazri," we were off by seven to do the journey and see the various places of interest through Vijayanagar and Hampi on to the Vithalaswami Temple. Vijayanagar was the place of residence of the kings and aristocracy, and where the Government buildings existed. All these were in a walled enclosure, as already mentioned. The fortifications consisted of a double wall and ditch on the open sides to the south and west,

the river Tungabhadra, unfordable for many miles to the north, and the mountains to the north-east. These formed a chain of immense strength, which must have been formidable in the then conditions of warfare.

Hampi was the chief commercial centre, and it is said that the king had a town house in the main street. We found our guide of yesterday waiting to go with us and to put us in the way of seeing at once the places of interest on the way. He was the cause of a great saving of time, and enabled us to see practically all in the day. Until the Archæological Department took the work of restoring in hand it was difficult to get round the place. Now there is a fairish road from Kamalapuram to Hampi. It must be mentioned that the old site is practically uninhabited except for the keepers in the two or three temples—where worship has been revived, or has never been in abeyance, as in the Pampapati Temple —and a few poor families in Hampi.

Passing by the places visited the previous day, we made our way to the entrance of Hampi in our conveyance. About half a mile before the gate of Hampi, where the road turns sharply between two small temples, in one of which the Eastern worship is still carried on, there is a monument, consisting of two slabs, marking the spot where two widows committed "sati." Just outside the gate, on the left, is a large statue of Vishnu, standing about 20 feet high. It is in a fair state of preservation, but has both arms broken off above the elbows; no temple is attached to this god. On going through what was the main gate to Hampi, we saw on the left the ruins of the large temple of Krishnaswami. It was built in 1513. The carvings in this temple are not to be compared with those in some of the temples; it has a fine frontage. To the east are the ruins of the bazaar leading to the main entrance; the chief street of this bazaar is now a rice field. The main building has the usual complement of out-houses surrounding it. On a small hill above this is a Jain temple, and near by a figure of the elephant god.

A rough bit of road and sharp ascent brought us to the crest of the hill, and the ruins of Hampi and the chief temple Pampapati came into view with the Tungabhadra beyond.

This temple escaped destruction at the hands of the Mahommedans; why it was overlooked or undisturbed is not clear. The Brahmans assert that the power of the god was so great and forbad it. It is held in great veneration by the Hindus, and pilgrimages are made from great distances to worship and bathe in the Tungabhadra. Of recent years this has been stopped on account

of the spreading of plague. Its endowment consists of the revenue obtained from several villages in the neighbourhood.

On the hills above are five Jain temples, of course deserted, and above these a small shrine built entirely of stone, which is supposed to be of great antiquity. Pampapati is built practically on the river bank, and has a great tower, "which was erected by Krish Deva Raya to celebrate his accession," and is quite a feature. On entering we came to the outer court, in which we saw a small complement of visitors and worshippers, bullocks and donkeys; the place was very dirty. Though not allowed to enter, we looked through the gate to the inner court beyond, behind which was a

FIG. 2.—Pampapati Temple.

shrine and the resting place of the god, represented by a round stone in the shape of half a football, so we were told. Some parts of this temple are said to be older than the beginning of the kingdom of Vijayanagar itself.

We now went down the main street of the principal of the bazaars that constituted Hampi, with the remains of houses and shops. Many are of fair size, with an upper storey, while others were small, only of one storey, and probably were the shops. There is no sign of beauty of design about any of them, and we could not pick out which of the houses might have been the king's town house. What strikes one is the fine wide street, at least 35 yards, which is so much in contrast with the usual narrow streets that make up the present bazaars. At the end of this street, of about

800 yards, you come on the river by a sharp turn to the left. We now had to leave our conveyance and walk for about a mile and a half. A rough embankment, about 20 feet high when the river is not in flood, has been built, so that one may continue along the river bank for about 200 yards until Kodanda Ramaswami temple is reached, on the bank of the river. Worship is still carried on here. It did not seem of much importance, so we passed on, leaving it on our right. Taking a little turn inwards from the river, another section of old Hampi came into view. It consisted of ruins of houses, which appeared to be of lesser importance than Hampi proper, on both sides of a wide street. This goes by the name of "Dancing Girls' Street," and is now a rice field. I could get no explanation as to the name. At the top of the street is Achyutaraganiswami Temple. This is a good district for panthers, and the keen sportsman hardly ever fails to secure his animal, even on his first hunt. A night or two before our visit, a panther had secured a cow and carried it to this temple, where he made his feast in peace, leaving only the bones to tell the tale. On the top of the high rocky hill to the right stands the temple Matanga Parvatam. Having already had over four hours' going we could not face the big climb, so missed this, but I believe it is worth a visit. It is being restored, that is to say, such work is being spent on it as will prevent further decay.

Continuing our walk in a northerly direction, we passed the pond on our left, which was said to be the bathing place of Sita, wife of Rama. Here one sees also the ruins of a bridge which crossed the river. A few yards further on are two tall stone uprights, connected by a stone beam. One would almost think it was a place of execution, but not so; the story goes that it was used for hook-swinging festivals.

Another half mile or so brought us to Vithalaswami Temple. One is well rewarded for the mile and a half walk to see this place. It is in a fair state of preservation in some parts, though much injury was done by the Mahommedans. It is surrounded by a high wall, and consists of several buildings. The carvings are beautifully and marvellously executed, representing the usual type of figures and animals. This appears to be a lost art among the Hindus. All the main pillars, with magnificent carvings on them, are wrought out of single blocks of stone. A fine specimen in the centre of the court is the car carved out of one huge granite boulder, and has two elephants in front. A large crack, which rendered it in danger of falling in two, has recently been repaired. This temple was never furnished or consecrated.

This temple, as usual, had its adjoining complement of houses and shops in front, forming the bazaar facing the main gate, now represented by a few ruins on each side of what was once a street.

FIG. 3.—Stone Car. Carved out of one solid boulder.

FIG. 4.—Vithalaswami Temple. Interior.

To the east of this temple are the remains of another bazaar, the main street running about north and south, and at the north end is the temple of Siva. This is a deep low structure, gloomy in the interior. It is a very modest erection and altogether overshadowed

by Vithalaswami, but remains as another monument to the fallen glory of Hampi. All along the road to Vithalaswami on the rising ground, here and there, were seen many small Jain temples. This was the end of Hampi.

Being fairly tired after our walk back we were glad to have the "bandy" to take us back the remainder of the journey. In the afternoon we went along the Kampli road. About half a mile out, the first place of interest you come to is the Jain temple of Ganigetti. It is not large. The tower above it is built in the series of steps which is the most noticeable characteristic of the Jania temples. About one and a quarter miles along the road we came to Malyavantha Raghunathaswami Temple, situated on a high rocky hill on the left of the road going out. At the foot of the hill there is a new Juggernaut car, finely carved in wood, almost new. This is taken out once a year, at festival time, and drawn along the Kampli road by Brahmans. It was a rather difficult business getting to the top of the hill, and more so coming down, over some rough steps and slippery granite slopes. Coming down we found it safer to take off our boots and walk in socks. It is a Vishnu temple, and there is a separate one to his wife. We were allowed to walk in the courtyard and unused parts, but not to go inside, for though it had been a deserted temple, in recent times worship has been revived and is regularly carried on now. One sees the usual carvings of fishes and other fanciful monsters on the walls and pillars, which though fairly good, do not deserve much mention. Many monkeys were frolicking about the courts, which disappeared up the walls on our approach. Bulls occupied one of the buildings and the place was very dirty Outside the wall of the temple, and on a higher spur, is a shrine cut out of a huge boulder. From this spot a beautiful view of the surrounding country is obtained, with glimpses of the Tungabhadra winding here and there among the mountains

The whole country for miles around is mountainous, and everywhere are to be seen enormous boulders of granitic rock in every conceivable position of unstability: "As far as the eye can reach for ten square miles there is nothing between heaven and earth but boulders; the earth is paved with them, the sky is pierced with them—literally in thousands of all sizes—heaps upon heaps, in one instance 250 feet in height."[1]

The following morning we revisited some of the interesting

[1] "Madras District Gazetteers," Bellary, by W. Francis, Indian Civil Service.

places and also the underground temple in the vicinity of Hazar Rama Chendra. It appears underground now, because excavations have brought to light that the temple proper is underground as it now exists. Whether this was originally really so built, or became filled in by earth and *débris* at the time of the destruction of Vijayanagar is not certain; probably this was the case. This brought us to the end of our sight-seeing, and well pleased we were to have had the opportunity of making the visit to such an interesting place in Hindu history. Not a little of the pleasure was that we had the advantage of the company of Mr. Sabba Ramayya to show us round and give us information.

Current Literature.

Further Observations on the Results of Anti-typhoid Inoculations amongst the German Troops in South-West Africa.—A preliminary communication on the results of the German experience of anti-typhoid inoculations, of which a translation appeared in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS of March, 1907, was published in the *Archiv. für Schiffs- und Tropen-Hygiene* in December, 1905. In the issue of the *Deutsche Militärärztliche Zeitschrift* of April 24th, 1907, a further communication is published by Stabsarzt Dr. Kuhn, who was attached to the German headquarters in South-West Africa. His notes are taken from material in the office of the Principal Medical Officer of the Command, and have, therefore, a claim to being considered officially accurate. They are based on information obtained from the lists of men inoculated and from the returns of enteric fever submitted to headquarters every ten days. Complete material is not yet available, especially in regard to the medical history of the cases, and, as Dr. Kuhn remarks, on this account a conclusive opinion regarding the value of the inoculations cannot yet be formed.

The lists of men inoculated include up to date 7,287 men, some of whom have been inoculated once and some more than once. In none have bad effects following inoculation been brought to notice. At the commencement, *i.e.*, up to May, 1905, the dose of the first inoculation was 0·5 c.cm., for the second 1·0 c.cm., and for the third 1·5 c.cm., of dead agar cultures of typhoid bacilli. The inoculation material was obtained from the Institute of Infectious Diseases at Berlin. The symptoms after inoculation varied in an extraordinary manner amongst individuals; some showed no general symptoms at all, but the majority had slight fever and malaise lasting for one or more hours. About 12 to 17 per cent. of the inoculated suffered from vomiting. About 2 per cent. on an average had high fever up to 104° F., or long-continued malaise up to forty-eight hours. The local reaction was practically the same in all cases, and consisted of redness and swelling at the site of inoculation over an area that could be covered by a saucer. This caused severe pain

for one day, and as a rule had not completely disappeared after two days. In most cases the men inoculated were unfit for duty until the second day.

The symptoms after inoculation were exceptionally severe in the case of the first inoculations of the men of Contingent "Y," on May 18th and 19th, 1905, 38·3 per cent. suffering from vomiting. Although this was probably due to the excessive heat at the time, the doses were reduced afterwards to 0·3, 0·8, and 1·0 c.cm. in order to avoid these severe effects. The general symptoms after this were less severe, and vomiting occurred only in a small proportion of the inoculated. The period between the inoculations was seven to fourteen days, so that inoculation was completed in three or four weeks.

Dr. Kuhn then goes on to remark that the above observations have fulfilled the first two of the conditions laid down regarding the practice of anti-typhoid inoculations, namely: (1) Simplicity and little interference with military duty in carrying out the process of inoculation, and (2) The slightest possible physical disturbance subsequent to inoculation. He then proceeds to discuss how far the third requirement of inoculation has been met, namely, undoubted diminution in sickness and mortality owing to immunity acquired by inoculation.

Of the 7,287 men inoculated, 1,950 were inoculated once, 3,615 twice, 1,578 three times, while, as regards 144 of the men, the number of inoculations is uncertain. Deducting these 144, 27·30 per cent. of the remaining 7,143 were inoculated once, 50·60 twice, and 22·10 per cent. three times. The number of inoculated is made up as follows: 312 were inoculated during 1904, of whom 262 were inoculated before and during the voyage to South-West Africa, and about 50 in South-West Africa. Of the 7,051 men who went out in Contingents "S" to "Z 9" after December 31st, 1904, 6,075 men were inoculated before or during the year 1905, and 1,971 from the beginning of 1906 up to June, 1906. In South-West Africa itself about 900 men were inoculated from the beginning of January up to June, 1905, when inoculations there were discontinued on account of fear of exposure of infection during the negative phase.

Dr. Kuhn gives the table on next page, showing the average strength and enteric statistics for May, 1904, to February, 1907, month by month.

The figures show a steady diminution in sickness and mortality from enteric fever after the first year. From May to the end of 1904 the admission rate was 42 per thousand, and the death-rate 4·6 per thousand; in the first half year of 1905 the ratios were 23·0 and 1·5; in the second half of 1905, 12·0 and 0·5; in the first half of 1906, 10·0 and 0·7; in the second half of 1906, 6·0 and 0·4; in the first two months of 1907 the ratios were 5·0 and ·08 respectively. From this Dr. Kuhn concludes that anti-typhoid inoculations, which began to have effect from the commencement of 1905, must be regarded as having played a part in the reduction of enteric fever, although, he says, other favourable conditions must not be excluded.

At the beginning of 1905 about 262 men of the 10,305 then in the territory had already been inoculated, and it is estimated that about a thousand men had already had enteric fever, so that it is inferred that at the beginning of 1905 there were about 9,133 men in the territory who had not yet acquired immunity by inoculation. Of this number 900 were afterwards inoculated. Subsequently 6,075 inoculated and 976 un-

inoculated entered the territory, so that altogether there come under review 7,287 inoculated and about 9,209 uninoculated, apart from any consideration of those who had already recovered from enteric fever.

Month	Average strength	Average number of enteric cases	Proportion of cases of enteric per 1,000 of strength	Deaths from enteric	Proportion of deaths per 1,000 of strength
May, 1904	3,267	226	70	10	3·1
June ,, ...	3,256	223	68	12	3·7
July ,, ...	5,100	201	39	16	3·1
August ,, ...	5,789	130	22	17	2·9
September ,, ...	6,756	172	25	35	5·2
October ,, ...	7,467	186	25	36	4·8
November ,, ...	7,517	305	40	62	8·1
December ,, ...	8,195	424	50	48	5·9
January, 1905	10,295	336	32	12	1·2
February ,, ...	11,513	226	20	12	1·0
March ,, ...	11,874	194	16	13	1·1
April ,, ...	13,328	246	19	21	1·6
May ,, ...	13,478	309	26	27	2·0
June ,, ...	13,536	348	26	26	1·9
July ,, ...	13,978	266	19	22	1·6
August ,, ...	13,941	201	15	6	0·4
September ,, ...	13,950	159	12	8	0·6
October ,, ...	14,126	129	9	12	0·8
November ,, ...	14,118	131	9	12	0·8
December ,, ...	14,398	162	11	15	1·0
January, 1906	14,678	146	10	18	1·2
February, ,, ...	15,849	167	10	18	1·1
March ,, ...	15,719	154	10	9	0·6
April ,, ...	15,588	159	10	8	0·5
May ,, ...	15,296	167	11	7	0·5
June ,, ...	15,026	156	10	8	0·5
July ,, ...	14,756	137	9	5	0·3
August ,, ...	13,840	78	6	8	0·6
September ,, ...	12,676	47	4	0	0·0
October ,, ...	11,384	68	6	3	0·3
November ,, ...	10,287	50	5	3	0·3
December ,, ...	9,596	60	6	5	0·5
January, 1907	9,131	50	5	7	0·7
February ,, ...	8,696	43	5	8	0·9

The statistical cards of enteric fever throw light upon the manner in which these two large groups have been affected by enteric fever. These cards were sent in from the various hospitals in the neighbourhood of Windhuk to the Principal Medical Officer's office in Windhuk from the beginning of April, 1905, and from out stations at a later date. They were continued up to date, *i.e.*, February, 1907.

1,280 cards were thus available for Dr. Kuhn's investigations, and he states this number corresponds very nearly with the reported number of cases of enteric fever. Of the 1,280 cards three did not contain sufficiently precise entries, so that the actual number used for statistical purposes is 1,277. Of this number 906 represent cases of enteric fever amongst men who were not inoculated, and 371 cases amongst the inoculated. The cases therefore amongst the uninoculated are equivalent to 9·84 per cent.

of the strength of uninoculated troops, and the cases amongst the inoculated to 5·09 per cent. of inoculated strength.

Dr. Kuhn concludes from this that the inoculated have suffered less than the uninoculated, and that inoculation has consequently caused a diminution of enteric fever. This, he says, is all the more probable because the inoculated were just as much exposed to risk as the uninoculated, and, further, when the authorities commenced to send men home, from the end of 1904 onwards, those who were longest in South-West Africa went home first, and these were more likely to be uninoculated than inoculated men, so that from 1905 onwards the number of uninoculated in the territory was being gradually diminished.

Differentiating the cases according to severity of attack, Dr. Kuhn presents the following statistics:—

	Uninoculated	Inoculated
Light attacks	331 (36·55 per cent.)	186 (50·13 per cent.)
Moderately severe	225 (24·85 per cent.)	96 (25·88 per cent.)
Severe	234 (25·80 per cent.)	65 (17·52 per cent.)
Fatal	116 (12·80 per cent.)	24 (6·47 per cent.)
Total	906 (100 per cent.)	371 (100 per cent.)

These figures indicate that the inoculated show a higher per cent. of light cases and a lower per cent. of severe cases, while both the uninoculated and inoculated show practically the same percentage of moderately severe cases.

In the series of 424 cases, the statistics of which were given in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for March, 1907, the following were the results:—

	Uninoculated	Inoculated
Light cases	42·3 per cent.	66·0 per cent.
Moderately severe cases	21·3 ,,	20·0 ,,
Severe cases	25·3 ,,	10·0 ,,
Fatal cases	11·1 ,,	4·0 ,,

Comparing this series with his own series of figures, Dr. Kuhn comes to the conclusion that the course of enteric fever cases has been more unfavourable both in the inoculated and uninoculated in his series of cases than in the preliminary series, because the percentage of severe and fatal cases has increased. He makes no allowance for probable error in dealing with small numbers, and endeavours to explain the less favourable course of the disease by attributing it to difficulties in treatment in the southern area of operations in consequence of defective means of communication.

The next series of statistics shows the period after inoculation at which the cases among the inoculated contracted the disease. The following results are given:—

Light Cases.

	Once inoculated	Twice inoculated	Three times inoculated
One week	1	2	—
Two weeks	1	2	—
Three weeks	—	1	—
Four weeks	1	2	—
Two to six months	30	52	23
Seven to twelve months	13	20	12
Over twelve months	13	12	1
Total	59	91	36

Moderately Severe Cases.

	Once inoculated	Twice inoculated	Three times inoculated
One week	—	—	—
Two weeks	—	—	—
Three weeks	..	—	—
Four weeks	..	—	—
Two to six months	11	22	11
Seven to twelve months	7	11	7
Over twelve months	5	14	8
Total	23	47	26

Severe Cases.

	Once inoculated	Twice inoculated	Three times inoculated
One week	2	2	—
Two weeks	—	—	—
Three weeks	—	—	—
Four weeks	—	—	—
Two to six months	12	12	4
Seven to twelve months	2	10	3
Over twelve months	11	4	3
Total	27	28	10

Fatal Cases.

	Once inoculated	Twice inoculated	Three times inoculated
One to four weeks	—	—	—
Two to six months	5	3	1
Seven to twelve months	5	1	1
Over twelve months	4	4	—
Total	14	8	2

There have therefore been 123 cases amongst those who have been inoculated once, 174 amongst those inoculated twice, and 74 amongst those inoculated three times. These numbers represent 6·31 per cent, 4·81 per cent., and 4·69 per cent. respectively of the strength of those inoculated once, twice and three times. Dr. Kuhn regards the results sufficient to warrant the conclusion that those inoculated once suffer more frequently than those inoculated twice, and those inoculated twice more than those inoculated three times, and he adds, when the percentages are compared with that of the uninoculated, namely, 9·84 per cent., the figures give a good idea of the results of inoculation.

When he distributes the cases amongst those inoculated once, twice, or three times into the four groups of light, moderately severe, severe and fatal, he brings out the following percentages :—

	Inoculated once	Inoculated twice	Inoculated three times
Light cases	31·72 per cent.	48·93 per cent.	19·35 per cent.
Moderately severe cases	23·95 ,,	48·96 ,,	27·09 ,,
Severe cases	41·54 ,,	43·09 ,,	15·40 ,,
Fatal cases	58·33 ,,	33·33 ,,	8·33 ,,

This brings out more clearly the favourable effects of the greater number of inoculations.

In discussing the evidence of a negative phase, Dr. Kuhn emphasises the fact that none of the cases amongst those inoculated three times occurred during the first four weeks after inoculation, and he concludes

from this that it is questionable whether the negative phase exists after the third inoculation, but in this connection he considers that it has yet to be determined whether this is due to the third inoculation itself, or to the greater period that has elapsed since the first and second inoculations.

The next investigation from the statistics is made to determine the duration of the immunity conferred by inoculation. On this point the following figures are presented:—

Cases Occurring between Two and Six Months after Inoculation.

Light	105 (56·45 per cent.)
Moderately severe	44 (23·65 per cent.)
Severe	28 (15·05 per cent.)
Fatal	9 (4·85 per cent.)

Cases Occurring between from Seven to Twelve Months after Inoculation.

Light	45 (48·91 per cent.)
Moderately severe	25 (27·17 per cent.)
Severe	15 (16·31 per cent.)
Fatal	7 (7·61 per cent.)

Cases Occurring more than Twelve Months after Inoculation.

Light	26 (32·91 per cent.)
Moderately severe	27 (34·88 per cent.)
Severe	18 (22·78 per cent.)
Fatal	8 (10·13 per cent.)

In considering these figures Dr. Kuhn comes to the important conclusion that they indicate that the immunity conferred by inoculation is lost after one year. He gives as his reason for this that the percentage of the moderately severe, severe and fatal cases occurring amongst the inoculated after one year is increased by 14·18, 12·78, and 6·13 per cent. respectively, as compared with the corresponding figures of the first series of cases previously published, and that the percentage of light cases has decreased by 33·09 per cent. Further, he states that the severer cases, after one year amongst the inoculated, show almost as high a proportion as the uninoculated. To show this he gives the figures of the light, moderately severe, severe and fatal cases amongst the uninoculated for the year 1906, namely, 81 (30·92 per cent.), 96 (36·63 per cent.), 52 (19·85 per cent.), and 33 (12·59 per cent.) respectively.

He points out that, as compared with the figures previously published amongst uninoculated, the percentage of severe cases is considerably lower and the fatal cases only slightly higher, a fact that is in marked contrast with the considerable increase in the percentage in the severe and fatal cases amongst the inoculated one year after inoculation.

The next subject of enquiry was that of complications amongst the inoculated cases. These occurred in 23, or 12·37 per cent., of the light cases; in 15, or 15·62 per cent., of the moderately severe; in 23, or 35·38 per cent., of the severe, and in 12, or 50 per cent., of the fatal cases.

The total number is equivalent to 19·7 per cent. of all the cases amongst the inoculated, the complications being inflammation of the lungs, tonsillitis, bronchial catarrh, cardiac affections, and so on. Amongst the uninoculated, complications occurred in 36·42 per cent., namely, 44, or 13·29 per cent., amongst the light cases; 79, or 35·11 per cent., amongst the moderately severe; 145, or 61·96 per cent., amongst the severe, and 62, or 53·45 per cent., amongst the fatal cases. Concurrent diseases, such as malaria, dysentery and venereal diseases, occurred in 24, or 3·71 per

cent., of the inoculated cases, and in 56, or 6·16 per cent., in uninoculated cases. Dr. Kuhn thus draws attention to the fact that complications are nearly twice as great amongst the uninoculated as amongst the inoculated.

The last series of statistics in the article deals with the question of the effects of dosage.

The following results are given :—

Light Cases.

First doses	Once inoculated	Twice inoculated	Three times inoculated
0·5 c.c.	41	69	24
0·3 c.c.	7	11	11
Uncertain	11	11	1
Total	59	91	36

Moderately Severe Cases.

First doses	Once inoculated	Twice inoculated	Three times inoculated
0·5 c.c.	12	39	14
0·3 c.c.	8	8	11
Uncertain	4	—	1
Total	24	47	26

Severe Cases.

First doses	Once inoculated	Twice inoculated	Three times inoculated
0·5 c.c.	22	22	7
0·3 c c.	5	2	2
Uncertain	—	4	1
Total	27	28	10

Fatal Cases.

First doses	Once inoculated	Twice inoculated	Three times inoculated
0·5 c.c.	8	5	1
0·3 c.c.	5	1	1
Uncertain	1	2	—
Total	14	8	2

Practically the same number of men are said to have been inoculated with the larger dose as with the smaller, and it is remarked that comparatively few cases occurred amongst those who were inoculated with the latter.

Dr. Kuhn, however, does not believe that the lesser dose has been the cause of the presumed higher degree of immunity, but that the results are due to the fact that from June, 1905, onwards, when the smaller doses were commenced, the chances of infection had been considerably diminished. He gives the following conclusions :—

Summary of Results.

(1) A considerably smaller number of inoculated contracted enteric fever as compared with uninoculated.

(2) A general diminution in sickness, consequent on a diminution in the risk of infection, has resulted from the general inoculation of the troops.

(3) The course of the disease amongst the inoculated is on the average much more favourable than amongst the uninoculated.

(4) The course of the disease is more favourable in proportion to the number of inoculations.

(5) The negative phase does not appear to exist after the third inoculation.

(6) Immunity consequent on inoculation lasts about one year.

(7) Differences in the effects of varying strengths of inoculation cannot be determined from the statistics, because those who were inoculated with smaller doses only arrived in the colony after enteric fever had begun to decline.

PRACTICAL CONCLUSIONS.

(1) So long as there exists in South-West Africa special risks of enteric fever, only those men who have agreed to submit to anti-typhoid inoculation should be selected to be sent out.

(2) Every individual should be inoculated three times before he lands in South-west Africa.

(3) As the negative phase no longer exists after the third inoculation, the third inoculation can be made on the way out.

(4) The results so far achieved, should encourage scientific institutes to make further investigations into enteric inoculations, especially as regards the strength of the doses.

These statistics and conclusions are given as they appear in Dr. Kuhn's article. The statistics must be regarded as derived from official sources of information; the conclusions are apparently Dr. Kuhn's own conclusions. Everyone who is interested in the question of anti-typhoid inoculation, and, indeed, everyone who is concerned with the prevention of this scourge of armies in the field, must be grateful to Dr. Kuhn and the *Deutsche Militärärztliche Zeitschrift* for publishing this important series of figures. On this point there can be no difference of opinion. But the figures scarcely justify the far-reaching conclusions which Dr. Kuhn draws from them. In the first instance, none of the percentages are submitted to the test of the limits of probable error. If they were, the slight differences from which positive conclusions are drawn, as, for example, the very slight difference of 0·12 per cent. in the incidence of enteric fever on those inoculated twice as compared with those inoculated three times, or the difference of 3·53 per cent. between those not inoculated at all and those inoculated once, are considerably reduced, practically vanish, or even assume a totally opposite aspect under the application of Poisson's formula. But a still more interesting test is the comparison of these statistics in the gross with the statistics of the South African War of 1899-1902, and with the statistics of the Russo-Japanese War. The German South-West African Expedition shows a very high proportion of inoculated troops, namely, 7,287 out of an average strength of 11,367 for the thirty-four months shown. In the South African War the number of inoculated men was probably not much greater than one-tenth of the average strength of 209,404 for the thirty-one months of the campaign. In the South-West African expedition the deaths from enteric fever shown on the Table amount to 529, which is equivalent to 46·5 per thousand of average strength for the whole period, or to an annual ratio of 16·3 per thousand per annum.[1] In the South African War the total number

[1] It may be noted that Dr. Kuhn's statistics from the 1,277 card cases show only 140 deaths, but they do not cover the whole period apparently.

of deaths amongst officers and men from enteric fever was 7,648, or 36·6 per thousand, of average strength for the whole period and an annual ratio of 14·1 per thousand. In other words, the death-rates for enteric fever in two somewhat similar expeditions and in somewhat similar geographical areas were actually less amongst the troops which were least protected by inoculation. It may also be noted that the entirely uninoculated troops in the Russo-Japanese War also showed a less incidence of mortality from enteric fever, although in this case the geographical areas are not comparable. Admission-rates are of little value in these comparisons, because of the remarkable differences in methods of diagnosis. In South Africa, for example, it was the fashion latterly to call every case of continued fever enteric fever, and this fact swelled the admission-rate enormously, while at the same time it greatly diminished the case mortality. The enteric death-rates are therefore the best tests for comparative purposes, and one is driven to the conclusion that these important and valuable statistics from the German South-west African Expedition do not go very far to clear up the question of the ultimate value of anti-typhoid inoculations, although they are the best series of statistics on the subject, so far as the test of war goes, that has yet been published. It is disappointing, for example, to find so high an incidence as 5·09 per cent., with a mortality of ·3 per cent., amongst troops to whom this prophylactic measure has been applied. In our own Army an organised system of testing the value of anti-typhoid inoculations, which is based on certain preliminary investigations and which eliminates sources of error as far as possible, is now in existence, and British medical science will, no doubt, be content to await the verdict of the Committee dealing with the question whenever the accumulation of facts warrants definite conclusions either of a negative or of a positive character.

W. G. M.

Experiments made during the Medical Manœuvres of the Military Government, Paris, 1906, in Lighting the Field of Battle.—Médecin-Major, 1st class, Jacob, Assistant Professor at the Val de Gracé, publishes the results of these experiments in the March numbers of the *Archives de Médecine et de Pharmacie Militaires.*

The existing regulations provide only four lanterns for regimental stretcher-bearers to each regiment, that it is to say, one lantern per battalion, and two lanterns for each field ambulance. This is insufficient, both as regards the number of the lanterns and as regards the quality of the light, to enable the bearers to work satisfactorily at night. Hence many proposals have been made for effectual lighting of the battlefield, and Jacob refers to previous experiments, commencing with an electric waggon, tried in 1886 in Germany, giving a light of 2,000 candle power, and Siemens and Halske's electric motor, tried in 1893. Nicolai, in 1899, and Rek, in 1902, experimented with portable acetylene apparatus. Wells' lamps were tried in Italy by Mendini in 1892, and by Warnecke in 1903, and various other devices, such as torches and flame apparatus, have been proposed. The Blériot acetylene lamp apparatus was considered the best of these.

Jacob was instructed to carry out experiments on these various methods during the medical manœuvres near Paris in 1906. He applied

first of all to the manufacturers to submit apparatus, and five responded, the apparatus being classified as follows:—

(1) *Apparatus carried on a Special Waggon.*—One only was tried, namely, the Gaiffe electric searchlight mounted on Gaiffe's Röntgen ray motor car. The light is very powerful, equal to a million candle power, and projecting a cone of light for one or two kilometres. It continues to work for four hours without changing the carbon, costs 4,500 francs, exclusive of the price of automobile and radiography apparatus, which is 18,000 francs.

(2) *Apparatus carried on a Small Cart by Two Men.*—Two of these apparatus were tried, the Fulgur and the Alpha. They are both acetylene lights, the former projecting light for about 50 or 60 metres, weighing 105 kilogrammes and costing 300 francs; and the latter weighing and costing less, but projecting a distance of about 500 metres.

(3) *Apparatus carried by One Man.*—Three were tried, namely, the Radignet and Massiot apparatus, the Blériot lamp already experimented with by Warnecke, and the Alpha lamp. The first of these is an oxygen light apparatus, weighing 13 kilogrammes, using in one hour 125 cc. of ether and 100 litres of oxygen. It costs 300 francs, and can be used for two hours without being recharged. The Blériot apparatus produces a luminant gas by means of "acetylithe" (calcium carbide previously dipped in petroleum and afterwards encased in glucose). It costs 37 francs and is carried as a lantern. The Alpha lamp is formed by acetylene dissolved in acetone. The apparatus costs 300 francs and is carried in the hand.

The six apparatus mentioned above were tried between 9 and 10 o'clock at night on suitable ground, *i.e.*, ground with hollows, undergrowth, long grass, ditches, &c. A stretcher squad with a medical officer and quartermaster worked with each light. The tests were made to determine the following requirements:—

(1) Intensity of light; (2) simplicity and ease of handling; (3) capacity of being worked by stretcher bearers or men of the Army Medical Service; (4) freedom from danger; (5) ease of transport; (6) strength; (7) moderation in price.

The Gaiffe projector gave the most brilliant light. In all other requirements it failed.

The Fulgur apparatus gave very bad results. It required experts and a large quantity of water, was very fragile and gave only a feeble projection.

The Alpha apparatus gave good results, but had the drawback of all powerful lights, namely, that of intensifying the darkness of places which the light could not reach.

The Radignet and Massiot apparatus gave a good and convenient light, but is complicated and fragile.

The Blériot and Alpha lamps were the most satisfactory, as regards all requirements of such lights.

Jacob's conclusions are exactly those formed by the writer of this note, who was present during the experiments to which the article refers, namely, that powerful searchlights do not fulfil the requirements of lighting battle-fields for searching for wounded, chiefly because, not only do they fail to illuminate the reverse sides of slopes, hollows, ditches, &c.

just those places where wounded seek cover, but they actually intensify the darkness of these spots and make it difficult for the stretcher-bearers to see wounded in them. Hand lights, such as can be carried with each stretcher squad, are the only satisfactory lights for the purpose.

W. G. M.

New German Diagnosis Tally.—(*Deutsche Militärärzt. Zeitschrift*, February 5, 1907). The old red and white diagnosis tallies have been replaced by a tally of uniform pattern. It is made of stout bank envelope paper.

Two red margins, which can be torn off, run down either side of the tally, and are intended to indicate whether the wounded man is fit or unfit for transport or capable of walking. If one margin is torn off this indicates fitness for transport; if both are torn off, fitness to walk; if neither is torn off, unfitness for transport. The printing on one side is as shown in diagram.

Unfit for transport	..	*Two red margins.*
Fit for transport	..	*One red margin.*
Fit to walk ..	..	*No red margin.*

Red margin.

Name.
(Rank, Regiment.)

Wound.
(Disease.)

Elastic tourniquet.
(Time of application.)

Administration of strongly-acting drugs.
(Time, dose).

Red margin.

On the reverse the medical officer signs his name and makes any remarks as to further treatment, &c.

Twenty-five tallies are bound in one block, with the following instruc-into within the cover:—

(1) Only medical officers may fill in the tally; (2) the tally is to be tied to the buttonhole of tunic, overcoat or shirt.

Each block is supplied with a graphite pencil.

W. G. M.

Correspondence.

ENTERIC FEVER AT AMBALA, 1880—1905.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In a letter from Major N. Faichnie, in the March number of the Journal, that officer refers to an article by Lieutenant-Colonel S. G. Allen on the above subject, and records his opinion that the fact of the introduction of a new piped-water supply from deep wells at Ambala, in 1905, should have been mentioned by Lieutenant-Colonel Allen, apparently considering that the new water supply was the chief factor in reducing the incidence of enteric fever at that station during 1905 and 1906.

Regarding the latter assumption I beg to bring forward the following facts:—

(*i.*) The new water supply was not brought into use until the autumn of 1905; not a single case of enteric fever occurred until July of that year. A severe epidemic of the disease prevailed during the autumn of 1904, and had continued until the middle of December.

(*ii.*) In February, 1904, a severe epidemic prevailed among two regiments in standing camps; the camp was shifted to a new site, and the epidemic ceased almost at once. The same water supply (old aqueduct) was used at both camps, and the means for boiling, storage and distribution were the same.

(*iii.*) The source of the old water supply at Ambala is deep wells, situated about five miles from cantonments.

No organism resembling the *Bacillus typhosus* was separated from the supply in 1904.

(*iv.*) Paucity of supply, and not impurity, was the chief cause of a new supply being introduced.

Major Faichnie sticks with astonishing pertinacity to his theory that enteric fever in India is *solely* propagated by water, and in doing so directly opposes the recorded opinion of a large number of his brother officers who have most carefully worked out the causation of the disease on the spot. Surely their unbiassed and deliberate opinion should have some little weight with Major Faichnie.

I am, &c.,
T. P. WOODHOUSE,
Lieutenant-Colonel, R.A.M.C.

Lahore Cantonment,
March 31*st*, 1907.

AN EXPLANATION!

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With regard to a letter headed "Wanted, an Explanation," by Colonel R. H. Forman, R.A.M.C., which appeared in the Journal for March, 1907, relating his experience at the Residency at Sarant Wadi, perhaps the absence of mosquitoes in the tanks and wet "paddy," which usually breed in such collections of stagnant water, is due to the fact that these particular tanks were kept clear of weeds and grass and stocked with fish, which are known to devour the larvæ in great numbers, such as "rohi" and "katla." In the village mentioned to be sixteen miles away, possibly no care is taken to keep tanks clean in any way, in fact, they are most likely always neglected and overgrown with jungle. Besides, the conditions of life of the villager and of the Resident must be very different. The former, living in mud hovels, very little raised off the ground, working all day in the heat and exposed to mosquito bites, with scanty clothing and a bare subsistance, with mosquitoes and children saturated with malarial parasites. The latter living in a well-built and well-ventilated house, having perhaps dormitories on the upper floor, and supplied with everything calculated to make life agreeable, surrounded by open ground and well-kept gardens.

I am, &c.,

Dum Dum, India, R. J. A. DURANT,
April 9th, 1907. *Major, R.A.M.C.*

A LITTLE KNOWN TREATMENT FOR SUNSTROKE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Having read the evidently hastily-written letter of Captains Hull and Reed, in the March number of the Journal, on the above subject, I do not consider they have made out a case against the use of iced enemata, and from the few remarks made and the solitary death quoted (which most probably occurred in a man whose bowel was in a collapsed condition), they certainly have not made their case any stronger or are justified in condemning the above old-established treatment.

Firstly—I think it is acknowledged in all the text-books, and from experience, that cases of heat-stroke suffer primarily from shock, which is later followed by collapse; therefore I think your correspondents have missed the point altogether when they describe the collapse as arising from the administration of iced enemata.

Secondly—as regards the death from "frost-bite of the rectum," the enema was probably given to a man admitted with symptoms of collapse, or "as a last resource" (see p. 342, March number), when the rectum was in a collapsed and insensitive condition, hence the prolonged exposure of the mucous membrane to a low temperature, and the resulting frost-bite.

I have repeated the enema three and four times in cases where the temperature would not come down, and as long as the rectum was not collapsed my cases showed no frost-bite. No, give the enemata early in the case, before any tendency to collapse has declared itself, and with a long rectal tube, to spread it over a larger surface of the bowel, and we shall hear of no more "frost-bites of rectum."

Thirdly—as regards the cases I cited, that were brought to hospital with all the prodromata of heat-stroke, *i.e.*, shock and with rapidly rising temperatures, I think I might lay claim to my diagnosis being correct, as they all occurred in the months of April, May and June, the months of least prevalence of malaria in Jhansi, and they all recovered without quinine.

I frankly admit I did not examine for malaria. Still, there is no mention of a blood examination in your correspondents' letter, and I do not wish to quibble with their diagnoses. During the rainy reason I saw one or two cases of hyperpyrexia from malaria, which, as stated, yielded to hypodermics of quinine. In these cases there were no symptoms of shock, neither were the patients unconscious.

As regards the criticisms *re* "little known," I have met both senior and junior officers in the Naval Indian Medical Service, and my own Service out in India, who have never heard of an "iced enemata," and the majority of those that have, picked it up from senior subordinates who most probably were taught it by our senior officers years ago at Netley.

I am, &c.,

The Crater, M. F. FOULDS,
Aden, April 30, 1907. *Captain, R.A.M.C.*

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—The hostile criticism in the March number of the Journal by the two Jhansi Captains of the Corps on the treatment of heat-stroke by ice-water enemata compel me to enter a strong protest, and to emphatically state that, in my opinion, no more ancient, efficient, or thoroughly reliable line of treatment exists; not, indeed, as a *dernier ressort*, but as the first line of attack for this most urgent and grave malady.

In Nowshera it was used thirteen years ago with marvellous—I had almost written miraculous—success. In Aden fourteen cases came under notice with two deaths, a case mortality of 1 in 7, which, I think, compares favourably with most statistics on the subject. All these were grave, typical cases of siriasis, and many had, unfortunately, the expected complications from excesses. Further, perhaps, I might quote the splendid results obtained by the Principal Medical Officer, Aden Brigade, Colonel

W. Hume-Henderson, while serving in Sind, and who speaks in the highest praise of this treatment. And lastly, as a practical conclusion of the whole matter, I feel assured that if the two Jhansi officers will once more give the treatment of ice-water enemata a fair trial, under their own personal supervision, they will not have to criticise and write "weighed in the balance and found wanting."

The thanks of the Corps are due to Captains Heppolette, I.S.M.D., and Foulds, R.A.M.C., for bringing Parke's powerful clinical suggestions once more to the fore-front in the battle with sunstroke.

I am, &c.,

Karachi,
March 29th, 1907.

FRANCIS J. TURNER,
Lieutenant, R.A.M.C.

CASE OF ASPIRATION OF THE LIVER, &c.

TO THE EDITOR OF "THE JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—May I be permitted to criticise the paper which appeared in your issue for last April (p. 436) on death following aspiration of the liver? It seems to me rather a pity that it was published at all, seeing the effect it will probably have on some of our officers who may not have had a large experience in the use of the aspirator in the detection of liver abscess.

From the description of the operation it would appear as though an aspirating needle had been used *which was not in direct communication with the vacuum in the bottle.* If a vacuum be produced in a bottle, and the tap on the needle side be turned on as soon as the point of the needle is buried in the skin, any air which may be in the needle and tube passes into the bottle. The operator then advances with a vacuum at the point of his needle. If he enters a large vein, the rapid flow of blood at once shows what has happened, and the needle can either be pushed further on or withdrawn. If, on the other hand, the unconnected needle be used, air may very easily enter if a large portal vein be entered. I cannot quite understand how it is possible for blood from the punctured portal vein to have found its way into the abdomen in the enormous quantity which was found there *post-mortem.*

It would seem to be a difficult matter for blood to force its way through a couple of inches or so of dense liver substance, even if the man had lived for some time after the puncture. As he died at once I would suggest that the inferior vena cava, or some other very large vein, was punctured by the needle, which had gone through the lower surface of the liver. The needle had been inserted rather low down, for we read that the puncture was only 2 inches above the lower margin of the liver. From some experiments I made last year in the *post-mortem* room I know how very easy it is, in aspirating low down, to pass the needle through

the under surface of the liver, especially if the organ is not enlarged very much in a downward direction.

The aspirating needle, which is supplied at home, measures $4\frac{1}{2}$ inches. If inserted in a line with the anterior axillary fold, it may easily reach the portal fissure or the inferior vena cava.

I am, &c.,

Colchester,
April, 1907.

F. J. W. PORTER,
Major, R.A.M.C.

THE JOURNAL.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—The suggestion in the "Editorial" in the March number, that bound copies of the Journal should be kept in all hospitals, is most excellent, and I hope will be adopted. I have so far had my Journal bound half yearly, and have carried it with me, but I have now presented it to the Station Hospital here, and hope that my successors will add the new volumes as they are complete. If every commanding officer of a hospital will take steps to do the same, there will be a complete set available for reference at any time, and at the same time no individual officer will have the trouble and expense of an increasing bulk of bound journals to take about the world with him.

I am, &c.,

Sitapur,
April 26th, 1907.

W. MOULD,
Major, R.A.M.C.

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